[redacted]

DETAIL SPECIFICATION

[redacted]

MERCURY CAPSULE NO. 2
CONFIGURATION SPECIFICATION
(MERCURY-REDSTONE NO. 1)
(Title Unclassified)

REPORT 6603-2 COPY NO. 10

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] AIRCRAFT

139pp.

[redacted]

SP-4

N-95-798

Control No. C-34401

DATE 2 June 1960

REVISED 6 February 1961

CLASSIFICATION CHANGE
TO = UNCLASSIFIED [redacted] E.O. 11652
By authority of [redacted]
Changed by L. Shirley Date 10-19-73

GROUP [redacted] at 3 year
Downgr[redacted] declassified
inter[redacted]
after 12 [redacted]ars

MERCURY CAPSULE NO. 2
CONFIGURATION SPECIFICATION
(MERCURY-REDSTONE NO. 1)
(Title Unclassified)

REPORT 6603-2 COPY NO. 102

5605308

McDONNELL Aircraft Corporation St. Louis Mo.

This material contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18 U.S.C., Sections 793 and 794. The transmission or revelation of which in any manner to an unauthorized person is prohibited by law.

SUBMITTED UNDER National Aeronautics and Space Administration
(NASA) Contract NAS 5-59

PREPARED BY R. D. Korando
R. D. Korando Feb. 6, 1961

APPROVED BY E. M. Flesh
E. M. Flesh
0 refs

APPROVED BY R. S. Chandler for
L. M. Parker

APPROVED BY

[redacted]

TABLE OF CONTENTS

R-1

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF FIGURES

INDEX OF PAGES

The pages of this report currently in effect are listed below in numerical order. The date listed after the page number identifies the latest revision affecting that page.

Page No.	Date	Page No.	Date
Title	2-6-61		
a	Removed	30	2-6-61
i	2-6-61	31	6-2-60
ii	6-2-60	32	2-6-61
iii	6-2-60	33	2-6-61
iv	6-2-60	34	2-6-61
v	6-2-60	35	2-6-61
vi	6-2-60	36	2-6-61
vii	2-6-61	37	2-6-61
viii	2-6-61	38	2-6-61
1	2-6-61	39	2-6-61
2	6-2-60	40	2-6-61
3	2-6-61	41	2-6-61
4	6-2-60	42	2-6-61
5	2-6-61	43	2-6-61
6	6-2-60	44	2-6-61
7	2-6-61	45	6-2-60
8	Removed	46	6-2-60
9	2-6-61	47	2-6-61
10	2-6-61	48	2-6-61
11	6-2-60	49	6-2-60
12	2-6-61	50	2-6-61
13	6-2-60	51	6-2-60
14	6-2-60	52	6-2-60
15	2-6-61	53	2-6-61
16	2-6-61	54	6-2-60
17	2-6-61	55	2-6-61
18	6-2-60	56	2-6-61
19	6-2-60	57	2-6-61
20	2-6-61	58	2-6-61
21	2-6-61	59	2-6-61
22	6-2-60	60	6-2-60
23	6-2-60	61	2-6-61
24	2-6-61	62	2-6-61
25	2-6-61	63	2-6-61
26	2-6-61	64	2-6-61
27	2-6-61	65	6-2-60
28	2-6-61	66	6-2-60
29	6-2-60	67	2-6-61

INDEX OF PAGES (Continued)

1.0 SCOPE AND CLASSIFICATION

1.1 SCOPE - This configuration specification shall define the details of design, construction, and equipment requirements for an Unmanned Instrumented Satellite Capsule (MAC No. 2 MR-1) as follows:

NASA Designation . . . . . Project Mercury

Designer's Name. . . . . McDonnell Aircraft Corporation (MAC)

Model Designation. . . . . Model 133K

Number and Places for Crew . . . . One Cabin Enclosure

Launch Vehicle . . . . . Redstone Missile

1.1.1 MISSION - The flight objectives of the Project Mercury capsule and Redstone missile combination (MAC No. 2 MR-1) shall be launching of this complex into a ballistic trajectory having a range of approximately 204 nautical miles, an altitude at apogee of approximately 113 nautical miles and total flight time of approximately 15.8 minutes. The atmospheric forces used in trajectory or other calculations shall be based on the atmospheric density and temperature variations presented in Paragraph 3.2.7, Figure 2, herein. R-1

1.1.1.1 The primary objectives of the ballistic test flight of Capsule No. 2 in combination with a modified Redstone missile shall be as follows:

a. Flight qualification of capsule-booster complex during boost phase designed to give maximum deceleration load factor during re-entry of 11g and period of weightlessness of approximately 5.2 minutes.

b. Flight qualification of capsule during re-entry at maximum deceleration load factor of 11g.

c. Flight qualification of retrograde rockets after a short period of weightless flight in space environment.

d. Flight qualification in part in the operation of landing system parachutes, automatic stabilization and control system, horizon scanner system, and other major components.

e. Flight qualification of recovery system.

1.1.1.1 MISSION - (Continued)

f. Flight qualification of posigrade rockets for effecting capsule-booster separation.

g. Gaining operational experience in launch, tracking and recovery phases of the mission.

Test program objectives involving capsules shall be the acquirement of data leading up to the primary concern of this research, that of man's ability to adapt to and perform in a space environment and those environments associated with projection into space and subsequent safe return to the earth's surface. The launching site for MR-1 shall be Cape Canaveral, Florida.

2.0 APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS - McDonnell Aircraft Corporation's prime objective relative to Government specifications shall be compliance with applicable documents to the most practicable extent, with the object of providing an optimum operational vehicle within the specified time schedule.

2.1 REFERENCES - The following documents are referenced herein.

MAC Report No. 6495, "Project Mercury Specification Applicability Criteria," dated 4 December 1958, revised 1 July 1959.

MAC Drawing No. 45-00003, "Qualification Status List."

NASA Specification No. S-6, "Specifications for Manned Space Capsule," revised 26 January 1959.

2.1.1 In event of a discrepancy between this specification and any document referenced herein, this specification shall take precedence.

2.2 PROCESS SPECIFICATIONS - The following MAC Process Specifications shall apply specifically to the Project Mercury capsule described herein: R-1

P.S. No.	TITLE
11051	Cementing of Heat Blankets for Model 133
11224	Sealing of Model 133 Capsule
12301	Cleaning of Model 133 Environmental Control System Lines and Nonoperating Components
12420	Chromic Acid Treatment of Aluminum Tanks for Model 133
13214	Black Oxide Finish for High Emissivity
13334	Preparation and Application of Coatings to Interior Surfaces of Sealed Cabin Area of Model 133
13430	Exterior Paint Finishing of Model 133 Capsules
14039	Fabrication of Model 133 Tower Insulation
16001.5	Marking of Model 133 Parts and Assemblies
17046	Care, Handling, Storage and Assembly of Model 133 Glass

2.2 PROCESS SPECIFICATIONS - (Continued)

P.S. No.	TITLE
17305	Sealing of Printed Wiring for Model 133 Flight Test Instrumentation
17400	Installation of Electrical Wiring in Model 133
17410	Fabrication of Electrical Wire Assemblies for Model 133
17410.1	Assembly of Electrical Cable Terminals and Splices for Model 133
17410.2	Assembly of Electrical Connectors for Model 133
17410.3	Assembly of Radio Frequency Cables for Model 133
20106	Storage and Handling of Silver Zinc Batteries for Model 133
20113	Care, Handling and Storage of Model 133 Pyrotechnics
20204	Repair for Skin Puncture on Model 133 Capsule Wall
20500	Fabrication and Housekeeping Policies Applicable to Model 133
20501	Requirements for Special Assembly Areas for Model 133
20505	Storage and Handling of Model 133 Environmental Control System
20506	Storage and Handling of Model 133 Reaction Control System
21030	Leak Testing of Model 133 Structural Assemblies
21311	Incoming Inspection of Model 133 Space Capsule Coatings
22810	Soft Soldering of Electrical Connections for Model 133

2.3 CONTRACT CHANGE PROPOSALS - The following MAC Contract Change Proposals (CCP's) have been incorporated and are considered applicable to Capsule No. 2 described herein:

CCP No.	TITLE	
3	Posigrade Rocket Installation	
6	Manual Emergency Controls	
13	Additional Capability of PAM Telemetry in Capsule Instrumentation Circuitry	
41	Reefed Ring-Sail Landing Parachutes, Installation of	R-1
42	Orbit Light; Specification Requirement Deletion	
43	Instrumentation Changes; Subcarrier Oscillator and Commutator Replacement	
44	Impact Pressure Measurement; Deletion of Requirement	
46-2	Supplemental Addition of Instrumentation, Telemetry and Communications Equipment	
48	Low Power Telemetry; Power Output Increase	
91	Elimination of Minitrack/Microlock Beacon	
92-1	Production Installation of Battery Compliment	R-1
93	SOFAR Bomb Installation (Quantity and Installation Provisions)	
97	Metallic Coating on Drogue Parachute; Deletion of	R-1
98	Smoke Recovery Aid; Removal of	
113	Escape Tower Ballast Reduction	
117	Retrograde Rocket Firing Information	
137	Installation of NASA Furnished SOFAR Bombs for Redstone Launches	

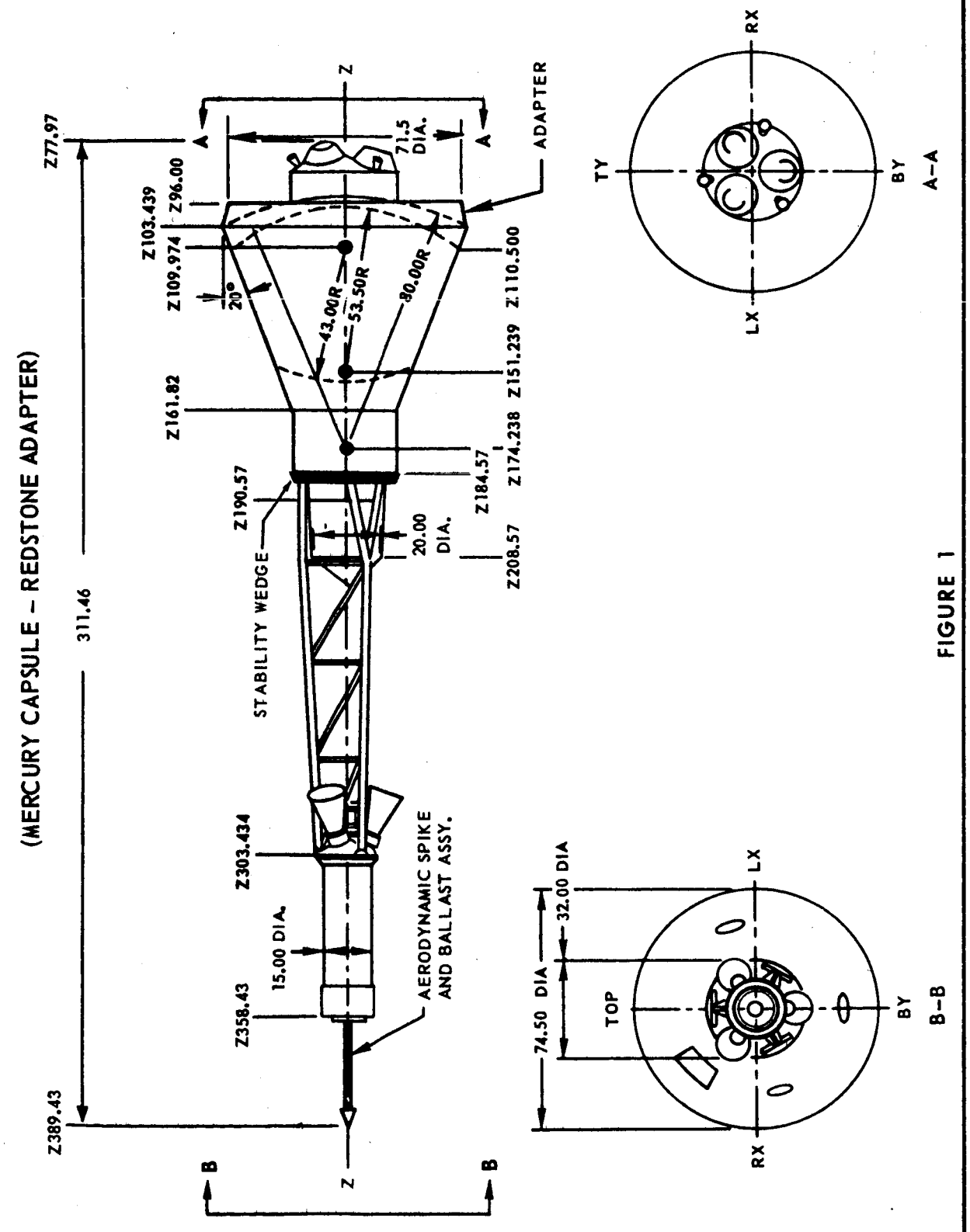

GENERAL ARRANGEMENT
(MERCURY CAPSULE – REDSTONE ADAPTER)
Z77.97
Z96.00
Z103.439
Z109.974
Z110.500
Z151.239
Z161.82
Z174.238
Z184.57
Z190.57
Z208.57
Z303.434
Z358.43
Z389.43
311.46
71.5 DIA.
ADAPTER
20°
43.00R
53.50R
80.00R
20.00 DIA.
STABILITY WEDGE
15.00 DIA.
AERODYNAMIC SPIKE AND BALLAST ASSY.
A
A
B
B
Z
RX
TY
BY
LX
A–A
32.00 DIA
74.50 DIA
TOP
B–B

FIGURE 1

3.0 REQUIREMENTS

3.1 CHARACTERISTICS

3.1.1 WEIGHT AND BALANCE - Specification MIL-W-25140 and Technical Order 1-1B-40 shall be utilized as reference guides.

3.1.1.1 GROSS WEIGHT - Mission history weight and balance summary as described herein shall be included after the actual weight and balance calculations are completed. R-1

3.1.1.2 LAUNCH WEIGHT - The launch weight of the Mercury Capsule No. 2 shall be attained by the addition of ballast in a manner such that the center of gravity is least affected. Weight and c.g. location shall simulate manned orbital capsules to the greatest extent practicable.

3.1.1.3 COAST PHASE WEIGHT - Coast phase weight is defined as the weight of the capsule when projected into the coast phase of the ballistic trajectory of the MR-1 mission.

This shall be defined as the effective launch weight less 0.2 of the weight of capsule system components jettisoned shortly after release of the booster and adapter, posigrade fuel used, H_2O_2 used for damping and orientation and coolant water used.

3.1.1.4 RE-ENTRY WEIGHT - Re-entry weight is defined as the coast phase weight, less hydrogen peroxide (H_2O_2) necessary for damping and orientation during this period, re-entry initiation, and less the retrograde rocket assembly.

3.1.1.5 ABORT WEIGHT - Abort weight is defined as the coast phase weight of the capsule less the retrograde rocket assembly plus the escape system.

3.1.1.6 IMPACT WEIGHT - Impact weight is defined as the re-entry weight, less the drogue and main parachutes, antenna fairing assembly, and less H_2O_2 and water used during re-entry.

3.1.1.7 WEIGHT AND BALANCE SUMMARY

(a) Mission history based on actual weight at launch: R-1

ITEM	WEIGHT	C.G.* LOCATION
Gross Weight Launch Vehicle	3874.46	170.61
Less: Escape Tower	-1031.37	
Gross Weight Tower Separated	2843.09	119.99
Less: Adapter - Capsule to Booster	-115.17	
Posigrade Fuel	-6.24	
Coast Phase Weight	2721.68	120.88
Less: H_2O_2 - Damping and Orient	-2.30	
Retrograde Weight	2719.38	120.89
Less: Retrograde Posigrade Assembly	-251.41	
H_2O_2 - Retrograde Hold	-10.84	
Re-entry Weight	2457.13	124.35
Less: H_2O_2 - Re-entry Hold	-3.00	
End of Re-entry Weight	2454.13	124.38
Less: Nose Cone Assembly	-78.00	
Main Chute Design Weight	2376.13	121.96
Less: Main Chute	-63.75	
SOFAR Bomb	-1.98	
H_2O_2 Jettison	-15.86	
Impact Weight	2294.54	120.77
Less: Reserve Chute	-63.24	
Pilot Chute	-3.57	
Dye Marker	-3.09	
Flotation Weight	2224.64	119.31

* C.G. location is given as Z station. Edge of heat sink is Z = 103.44

3.1.1.7 WEIGHT AND BALANCE SUMMARY - (Continued) R-1

(b) Abort Condition

ITEM	WEIGHT	C.G* LOCATION
Gross Weight Launch Vehicle	3874.46	170.61
Less: Adapter - Capsule to Booster	-115.17	
Retrograde/Posigrade Assembly	-257.65	
Abort Weight	3501.64	178.99
Less: Escape Rocket Propellant	-293.20	
Abort Weight - No Fuel	3208.44	165.49
Less: Escape Tower	-738.17	
Re-entry Weight - Abort Condition	2470.27	124.04

* C.G. location is given as Z station. Edge of heat sink is Z = 103.44

3.2 GENERAL DESCRIPTION

3.2.1 CONFIGURATION - The capsule configuration shall be of the type shown in Figure 1 and shall fulfill the requirements specified herein. The complete capsule shall be comprised of the following:

a. Structure (See Paragraph 3.4)

b. Heat and Micrometeorite Protection (See Paragraph 3.6)

c. Booster Adapter and Separation System (See Paragraph 3.7)

d. Crew Station (See Paragraph 3.8)

e. Consoles (See Paragraph 3.8.2)

f. Instrumentation and Display (See Paragraph 3.8.4)

g. Environmental Control System (See Paragraph 3.9)

h. Automatic Control System (See Paragraph 3.10.3)

i. Manual Control System (See Paragraph 3.10.3)

j. Retrograde Rocket System (See Paragraph 3.11)

k. Escape System (See Paragraph 3.12)

l. Power Supplies (See Paragraph 3.13)

m. Communication Equipment (See Paragraph 3.14)

n. Recording Equipment (See Paragraph 3.15)

o. Navigational Aids (See Paragraph 3.16)

p. Landing and Post Landing (See Paragraph 3.17)

q. Posigrade Rocket System (See Paragraph 3.11.4)

r. Handling Provisions (See Paragraph 3.18)

s. Pyrotechnics (See Paragraph 3.20)

3.2.2 SELECTION OF MATERIAL - Mission requirements of the capsule dictate use of high temperature resistant materials. Heat resisting materials such as titanium, beryllium, steel, nickel base alloy (Rene '41), and insulation materials such as Thermoflex, Fiberglas and ceramic coatings shall be used. Where practicable, materials in accordance with the requirements of ANA Bulletins 143d and 147r shall be utilized. R-1

3.2.3 FABRICATION - Structural design concepts of the capsule emphasize employment of proven manufacturing techniques and methods to the greatest possible extent. Maximum use shall be made of developed "off-the-shelf" components fabricated by dependable subsystem manufacturers. McDonnell Aircraft Corporation's standards of workmanship, processes and procedures are based on fabrication of production articles according to military standards.

3.2.4 INTERCHANGEABILITY AND REPLACEABILITY - The interchangeability and replaceability intent of Specification MIL-I-8500A(ASG) shall be met on those items of equipment possessing identical physical characteristics and functions in relation to capsule usage as defined in MAC Report No. 6495, revised 1 July 1959. Interchangeability and replaceability requirements are not considered mandatory on basic capsule structure.

3.2.5 FINISH - Definition of finish requirements shall be as specified in the finish specification, McDonnell Drawing No. 45-90000.

3.2.6 IDENTIFICATION AND MARKING - MIL-STD-130 shall be considered as a reference guide in identification of the capsule and capsule components. Marking shall be in accordance with MIL-STD-129B and Specification MIL-M-25047 as applicable. The words "UNITED STATES," in 6-inch block letters, shall be painted on opposite sides of the capsule. Capsule test cable plug or receptacle identification shall be in accordance with MAC Drawing No. 45-00010. External color requirements shall be in accordance with MAC Drawing No. 45-00009. R-1

3.2.7 EXTREME ENVIRONMENTAL REQUIREMENTS - Trajectory characteristics shall be based where necessary on the atmospheric density and temperature variations presented in Figure 2 on the following page. Earlier data may be used when its use is not critical or when it is compatible with Figure 2. The capsule, all subsystems, and components shall be designed to withstand the environmental conditions which are expected to be encountered during the mission outlined in Paragraph 1.1.1.

DATE 2 June 1960

REVISED

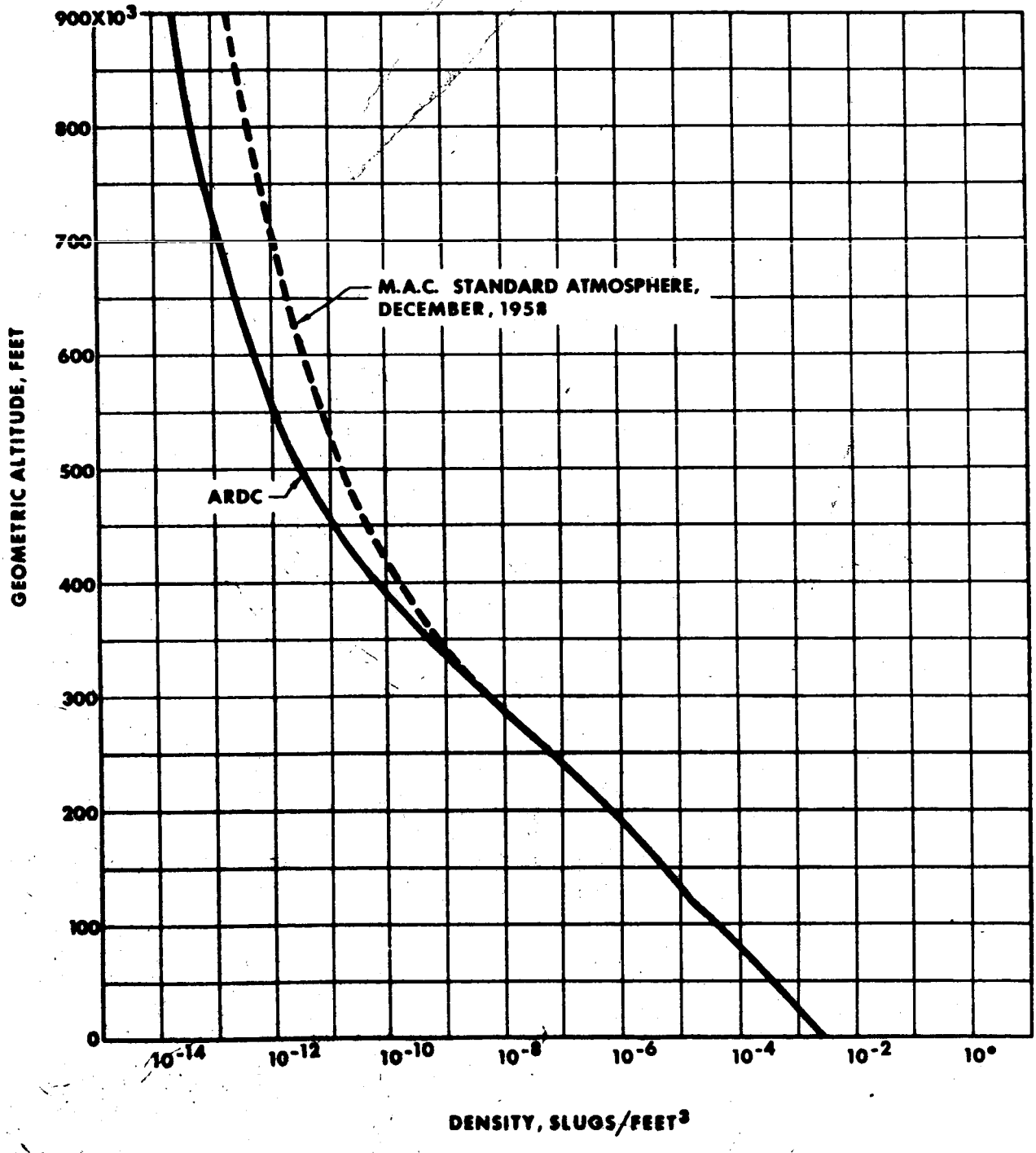
REVISED

McDONNELL

ST. LOUIS

ATMOSPHER

[redacted]

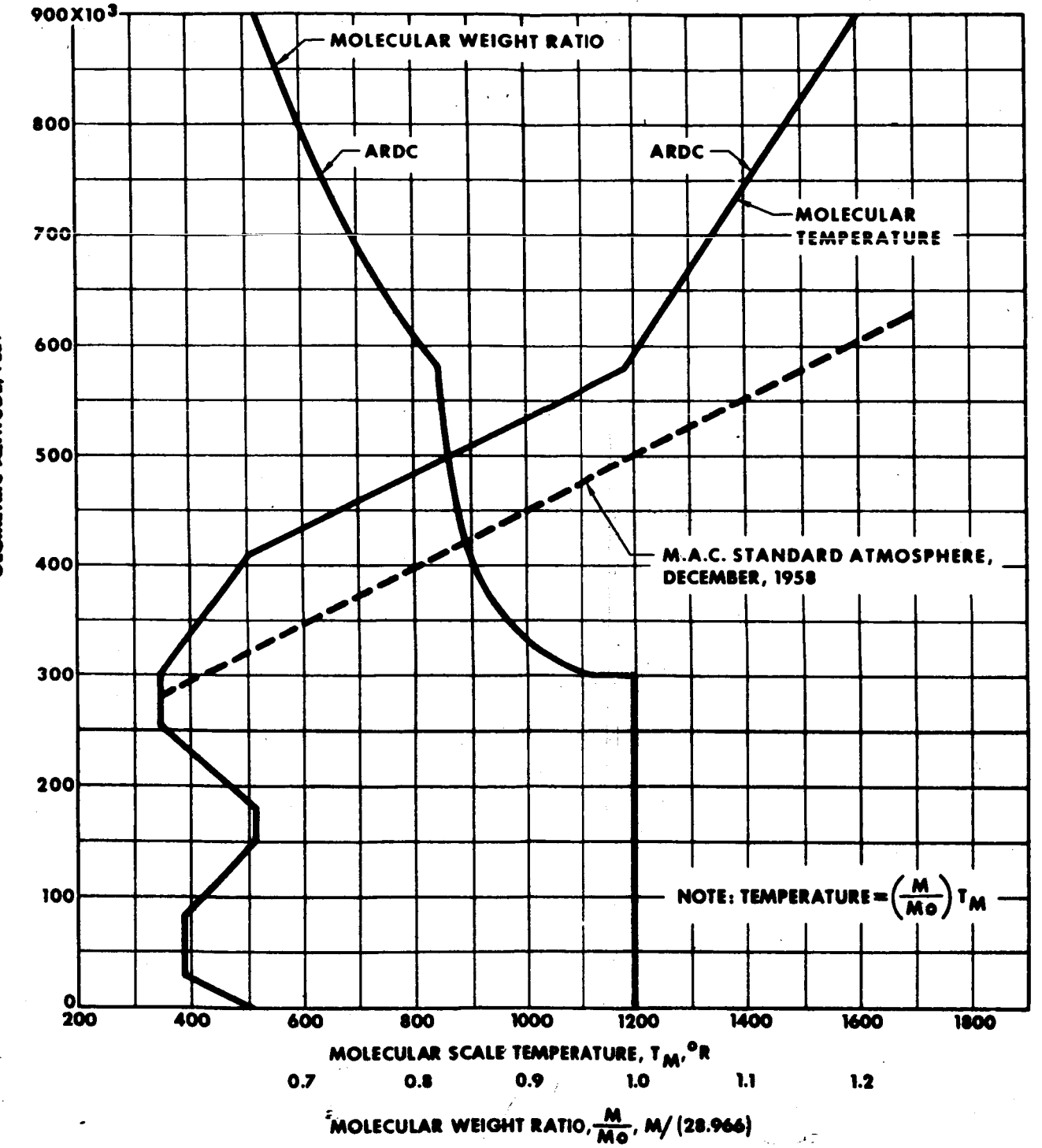


(A) ATMOSPHERIC DENSITY VERSUS GEOMETRIC ALTITUDE

[redacted]

FOLD OUT #1

...IC PROPERTIES



(B) MOLECULAR TEMPERATURE AND MOLECULAR WEIGHT RATIO VERSUS GEOMETRIC ALTITUDE

FIGURE 2

FOLD-OUT #2

3.2.8 LUBRICATION - Lubrication of components where required shall be in accordance with the requirements of Specification MIL-L-6880B, except for lubrication data charts. Lubrication data shall be included in maintenance handbooks. No petroleum base lubricants shall be used. Lubricants shall be of the silicone base, flourolube and dry film type. Lubrication shall not cause any toxic or flammable substances to occur in the cabin or in the environmental control system.

3.2.9 RELIABILITY - An integrated reliability program shall be conducted throughout the design, development and fabrication of the Project Mercury capsule. This shall include the salient features outlined in Specification MIL-W-9411 to the most practicable extent within the scope of the program. The design approach shall emphasize the safety of the mission. Although not specified herein in every instance due consideration shall be given to simplicity, redundancy, and the use of backup systems in order to improve mission reliability.

3.3 AERODYNAMIC AND HYDRODYNAMIC CONSIDERATIONS - The design configuration of the capsule described herein relative to aerodynamic and hydrodynamic considerations has been based on the following:

a. The overall capsule configuration at the time of re-entry shall be statically stable in the heat shield forward attitude.

b. Correct attitude during the re-entry phase shall be facilitated by use of a de-stabilizer flap located on the top of the antenna fairing opposite the roll axis horizon scanner.

c. Supersonic launch and escape drag shall be reduced by use of an aerodynamic spike and ballast assembly located on top of the escape rocket structural assembly. R-1

d. Design landing condition of the capsule has been based primarily for water impact with land impacts considered as an emergency condition.

e. The capsule shall be bouyant and stable upright in the water, heat sink down, and shall be capable of righting itself.

3.4 STRUCTURAL DESIGN CRITERIA - Structural design criteria of the Mercury Capsule No. 2 shall be as defined in MAC Report No. 6693, revised 3 August 1960, and Paragraphs 2.4 through 2.4.2.5 of NASA Specification S-6, revised 26 January 1959. R-1

3.5 CAPSULE

3.5.1 DESCRIPTION - The Project Mercury No. 2 capsule shall be of a conical configuration having an extremely blunt forebody with booster adapter attachment fittings and an afterbody which tapers to a juncture with a cylindrical section which shall support a truncated antenna cone and escape system pylon and rockets. The contours of the forebody shall be such as to provide the maximum practical wave drag and uniform surface heating consistent with other requirements. The afterbody configuration shall augment stability and provide adequate volume, and low heating as well as requirements for parachute stowage and escape system attachment. Internal volume of Capsule No. 2 shall be identical to the manned capsules which shall be based on a human occupant five feet ten and one-half inches (5'10-1/2") tall and weighing one hundred and eighty (180) pounds. R-1

3.5.2 CONSTRUCTION - The capsule shall be a semimonocoque structure of titanium construction consisting of a conical and a cylindrical section. The conical section shall consist of an unbeaded inner skin seam welded to a beaded outer skin with 24 equally spaced longitudinal stringers; two bulkheads from the pressurized cabin area. The cylindrical section shall have a single skin with 12 equally spaced stringers and internal shear webs which support the parachutes. The capsule structure shall be protected from heat, noise and micrometeorites by insulation and an outer covering of shingles plus a beryllium heat sink which shall absorb heat during re-entry. R-1

3.5.3 ENTRANCE HATCH - The entrance hatch located in the afterbody shall be of construction similar to the basic capsule. (See Figure 1.) Prior to capsule launch, the entrance hatch shall be bolted and sealed into position with bolts, and corrugated shingles shall be installed over the door.

3.5.4 EXIT HATCH - The exit hatch shall be located in the small afterbody pressure bulkhead. The exit shall be an inward opening plug type hatch with a latch type release handle and linkage. Handholds and steps shall be provided in order to facilitate egress through the top hatch. These may be integral structural components or equipment, which shall be reinforced and identified as necessary. The exit shall remain operable after a normal land impact. R-1

3.5.5 WINDOWS - Two windows shall be provided in the afterbody conical section. Each window shall consist of an outer window assembly, MAC No. 45-35025-1, and an inner window assembly, MAC No. 45-35010-1. The outer window assembly shall be located in the outer capsule skin directly in line with the inner window assembly and shall contain (1) one pane of glass which shall conform to the curvature of the

3.5.5 WINDOWS - (Continued)

capsule conical section. The inner window assembly shall be located in the inner capsule skin and shall contain (4) four panes of glass with an air space between each. The (2) two innermost panes shall be individually sealed and each shall be capable of withstanding pressures from within the capsule with the outermost of the two serving as a backup in the event the other pane fails. The two (2) outermost panes shall be a backup for the pane in the outer window assembly. The innermost of the two shall be coated with reflective material to impede thermal radiation in the cabin. In event of damage to the outermost pane, the next (inner) pane shall be capable of withstanding environmental conditions normally encountered by the outer pane if the glass in the outer window assembly should fail. R-1

3.5.6 ANTENNA FAIRING - An antenna fairing, MAC No. 45-31003-3, shall be installed between the cylindrical recovery compartment and the escape tower and shall extend from Stations Z184.57 to Z208.57. The antenna fairing shall house the pitch and roll horizon scanners and drogue parachute. An 8-inch window assembly, MAC No. 45-31044-1, consisting of a shell strengthened by 3 stiffeners and constructed of silicone base fiberglass laminate, shall be located around the outer base of the antenna fairing and shall act as a dielectric for the main biconical antenna. A destabilizer flap assembly, MAC No. 45-31026-301, shall be attached to the upper extremity and outer edge of the antenna structural assembly, MAC No. 45-31004-307, opposite the roll horizon scanner. The destabilizer flap shall prevent the capsule from becoming stable with the antenna fairing forward. Prior to capsule-tower separation, the destabilizer flap, which is spring loaded to the outboard position, shall be held flat against the antenna fairing by means of a quick release pin attached to the escape tower. The flap shall be released upon escape tower jettison. The antenna fairing shall be automatically jettisoned from the capsule as the capsule descends to 10,000 feet altitude. (See Paragraph 3.17.1.2).

3.5.7 ANTENNA COVER - An antenna cover assembly, MAC No. 45-31046-301, shall be incorporated in the escape tower structural assembly. R-1
The cover assembly shall shield the antenna fairing and horizon scanners during the launch period. The cover assembly, being an integral part of the tower, shall permit horizon scanning following tower separation.

3.6 HEAT AND MICROMETEORITE SHIELDING

3.6.1 FOREBODY HEAT PROTECTION - The capsule shall be protected by a dish-shaped heat sink which shall form the forward surface (forebody) of the capsule. The heat sink, MAC Drawing No. 45-32051-1, shall be fabricated of hot pressed sintered QMV grade beryllium, forged to its final size of 74.5 inches diameter with a spherical radius of 80 inches. The beryllium heat sink shall provide thermal protection by heat absorption during the MR-1 ballistic trajectory. Design consideration has been given to landing loads on the heat sink to insure that the pressure vessel is not punctured on water landings and that internal equipment is not damaged upon land impact. The heat sink shall be designed for retention on the capsule and shall be attached to the capsule conical structure assembly (afterbody) by a titanium heat shield attach ring. The attach ring, riveted to the capsule structure assembly, shall contain 48 elongated holes (to allow for thermal expansion) to mate with bolt holes spaced about the rim of the heat sink.

3.6.2 AFTERBODY HEAT PROTECTION - Afterbody heat protection shall consist of a radiation shield on the outside surface of the conical section with insulation between this shield and the primary structure. The radiation shield shall be composed of numerous individual corrugated shingles attached by bolts through oversize holes to allow thermal expansion while remaining within acceptable flutter limits. Shingle material shall be Rene' 41 on the antenna fairing and conical afterbody section and aluminum on the cylindrical recovery compartment. Thermal leakage to the inner structure shall be minimized by using insulation between the outer and inner skin. This insulation shall also serve to attenuate the external noise level.

3.6.3 MICROMETEORITE PROTECTION - Protection of the underlying pressure capsule against impacts from micrometeorites shall be provided by the use of the outer shielding skin specified above.

3.7 BOOSTER ADAPTER - MAC shall be responsible for matching the Project Mercury capsule to a modified Redstone missile as the launching booster. The capsule shall replace the missile nose cone in a manner which requires a minimum of modification to the booster system. The booster adapter, MAC No. 45-33600-1, for joining the Project Mercury capsule to the Redstone missile shall be of conventional semimonocoque aluminum steel and titanium construction, consisting of a machined structural frame utilizing a capsule match ring and a missile adapter ring, with titanium sheet metal skin reinforced by longitudinal hat sections spaced about the inner surface. The adapter shall be attached to the capsule by a clamp ring installation. The clamp ring installation shall consist of 3 segmented sections joined by 3 explosive tension bolts. Two (2) explosive bolts can be initiated electrically from either end by a dual electrical system. The third explosive bolt may be initiated electrically from one end only. Automatic adapter release shall be initiated by the missile engine shutoff sensor through a 10-second time delay to a capsule contained thrust cutoff sensor which shall sense booster engine cutoff and transmit a signal to a relay that energizes the electrical source for igniting the explosive bolts. Capsule adapter separation can be initiated by ground command (G-1 on sequential schematic, Figure 4, Page 43) through the abort circuit.

3.8 CREW STATION - The crew station in Capsule No. 2 shall be provided with the special instrumentation required for the mission as defined in Paragraph 1.1.1 herein. Equipment for astronaut support such as the support couch, restraint system, hand controller, emergency handle, food and water, waste handling, as well as aeromedical sensing instrumentation, shall not be required in this capsule. Instrument arrangement, warning device controls and communication equipment shall be essentially identical to equipment in manned capsules in order to monitor their operation in conditions representative of those to be encountered in the ultimate (orbital) mission.

3.8.1 Deleted

3.8.2 CONSOLES

3.8.2.1 LEFT HAND CONSOLE - A left hand console, consisting of two panel assemblies, MAC No. 45-81010-309, shall contain controls normally actuated by the astronaut in a manned capsule. These controls located on the outboard panel assembly shall include environmental controls for snorkel "open", and pressurize; gyro cage switch, auto "retro jett" switch, a "Fly-By-Wire" switch and fuel quantity indicator; retrograde rocket assembly heater switch and warning lights; and the cabin lights switch. The inboard panel assembly of the left hand console shall contain the telelight sequence and warning system with adjacent corrective action switches, the telelight command light, and warning light test switch.

3.8.2.2 RIGHT HAND CONSOLE - The right hand console, MAC No. 45-81002-1, shall contain environmental control knobs for cabin temperature, oxygen supply and internal circuit temperature. These shall be preset in the open position prior to launch.

3.8.3 INSTRUMENT PANEL - A main instrument panel assembly, MAC No. 45-81000-1, shall be provided in this capsule. The instrument panel shall be supported from the capsule structure at FZ 135.00 by a support fitting, MAC No. 45-32017-5, and by the periscope, MAC No. 45-86701-7 (see Paragraph 3.16.1). The instrument panel shall extend around both sides and the top edge of the periscope such that the scope display shall appear in the lower center of the instrument display. This installation shall provide an optical reference point which falls at the intersection of FZ 135.59 and TY 5.780 station lines. An adapter plate assembly, MAC No. 45-81039-1, shall be mounted on the lower left hand instrument panel for stowage of wiring installed for the astronaut observer camera, which shall not be provided in this capsule. The coolant quantity indicator and its wiring shall be installed in the capsule, but the indicator shall not provide any quantity indication. R-1

3.8.4 INSTRUMENTATION AND DISPLAYS - The instrument panel and left console as described herein shall contain instruments for indication of emergency, environment, vehicle and operational measurements. Basic instrumentation, depicting transmitting and/or recording methods for obtaining measurements defined below are as illustrated in Figure 6, Page 58. Instrumentation specified below shall be provided by the contractor, except for the cosmic ray recorders which shall be furnished by NASA. R-1

	Panel Indication	Recording Method (See Figure 6)
a. Capsule Environment		
Cabin Air Pressure*	X	X
Cabin Air Temperature	X	X
Instrument Panel Recording	X	X
Noise Level	-	X
Vibration	-	X
Humidity	X	-
b. Vehicle Measurements		
Acceleration (see Paragraph 3.8.4.3)	Long. Only	X
Clock (see Paragraph 3.8.4.1)	X	X

* Although this instrument is installed, no quantitative data will be derived from the capsule environmental control system.

3.8.4 INSTRUMENTATION AND DISPLAYS - (Continued)

	Panel Indication	Recording Method (See Figure 6)
Static Pressure	-	X
Structural Temperatures	-	X
Stabilization Control Motions (Pitch, Roll and Yaw)	-	X
Visual Attitude Reference (see Paragraph 3.16.1)	X	X
Attitude and Angular Rate (see Paragraph 3.8.4.2	X	X
Altitude (Altimeter)	X	X
Dead Reckoning Earth Path (see Paragraph 3.8.4.5)	X	X
c. Operational Measurements		
A.C. Voltage	X	X
D.C. Voltage	X	X
Sequence of Events (see Paragraph 3.8.4.4)	X	X
System Malfunction (see Paragraph 3.8.4.4)	X	X
Reaction Gas Quantity	X	X
D.C. Current	X	X
O_2 Emergency Flow	X	
O_2 Warning	X	
Package Ambient Temperature	-	X

3.8.4 INSTRUMENTATION AND DISPLAYS - (Continued)

	Panel Indication	Recording Method (See Figure 6)
Voice Recording	X	X
d. Scientific Observations		
Cosmic Radiation	-	X
Earth and Sky Observation	-	X

3.8.4.1 CLOCK SIMULATOR - An interim clock, MAC No. 45-81059-1, shall be provided as specified in Appendix I-C, Item 3 herein. This clock, a spring driven chronometer, shall indicate time of day, elapsed time (seconds) from launch, retrograde event time, and arbitrary elapsed time (stop watch). The retrograde timing mechanism shall have an adjustable time delay, 250-330 seconds, which shall be preset to the desired time of retrograde prior to launch. The retrograde timing mechanism shall, upon runout of the time delay, provide a retrograde fire signal. Signals of elapsed time from lift-off and retrograde time shall be transmitted to telemetry as indicated in Figure 6, Page 58, herein. Elapsed time (seconds) from launch shall be displayed on a Veeder-Root counter. This clock shall be installed in Mercury Capsule No. 2 in lieu of the satellite clock, MAC No. 45-81710-3, to be provided in later capsules.

3.8.4.2 ANGULAR RATE AND ATTITUDE INDICATOR - A combined angular rate and attitude indicating system MAC No. 45-81721, shall be provided as specified in Appendix I-C, Item 3 herein. This indicator shall indicate pitch, roll and yaw angles and angular rates. Pitch angles shall be indicated in the range of -130 degrees to +190 degrees. Yaw angles shall be indicated in the range of -70 degrees to +250 degrees. Roll angles shall be indicated in the range of -130 degrees to +190 degrees. The attitude portion of the indicator shall be driven by synchro signals obtained from the automatic stabilization and control system. (See Paragraph 3.10.1.) Angular rate indicators shall have a total range of $\pm$ 6 degrees per second. The retrograde index point on the MAC No. 45-81721-11 indicator shall be compatible with the zero pitch rate at -45 degrees on the pitch indicator dial. On manned capsules, the retrograde index shall mate with the zero pitch rate at -34 degrees on the pitch indicator dial.

3.8.4.3 ACCELERATION INDICATION - A modified standard accelerometer, MAC No. 45-81702-9, shall be provided for the longitudinal axis, in accordance with Specification MIL-A-25719, but shall not include positive and negative "g" memory pointers.

3.8.4.4 TELELIGHT SEQUENCE AND WARNING SYSTEM - A telelight-sequence and warning system in accordance with MAC Drawing No. 45-79720 shall be provided on the left hand console and the main instrument panel (see Appendix I-C, Item 4 herein). Direct reading legends shall be engraved in black on a frosted glass plate (nomenclature cap) and shall be readable when the lights are de-energized. Colors shall be in accordance with FED-STD-3. Brightness of the lights shall be as required by MIL-STD-411 for 24 volts application.

3.8.4.4.1 Displays indicated by the telelight system on the left hand consoles shall be as follows: R-1

(P-3)	Tower Jettison	⌀
(P-4)	Capsule Separation	⌀
(P-6)	Start Retro Sequence	*
(P-8)	In Retro Attitude	+
(P-7)	Retrofire	*
(P-10)	Jettison Retro	*
(P-11)	.05g Switch	*
(P-12)	Drogue	*
(P-13)	Main Deploy	⌀
(P-14)	Reserve Deploy	⌀
(P-15)	Rescue Aids	⊕
	Spare Positions (2)	

Switch numbers (P-13, etc.) correspond to those indicated in the sequential schematic, Figure 4, Page 43.

Manual override switches for the above functions shall be located adjacent to each telelight display. Switches ⌀ shall be ring type pull switches which shall provide override control either by dual independent electrical systems or by pyrotechnic initiators. Switches * shall be guarded push button type switches, which when depressed shall provide override control by dual independent electrical systems for each function

3.8.4.4.1 (Continued)

designated. Switch Θ shall be a ring type pull switch which provides mechanical override control consisting of a cable linkage to the launch oxygen valve. Switch + shall be a single-pole guarded toggle override switch labeled, "Retro Attitude Bypass" for the upper position and "Auto, Retro Attitude" for the normal down position. Switch ⊕ shall be a single pole toggle switch labeled "Post Impact" to the left and "Off" to the right. R-1

Normal operation of this panel shall provide a green light which illuminates upon completion of each chronological sequence and a red light which illuminates (after a time delay) should a malfunction occur in any sequence. The red light shall remain illuminated until corrective override action has been taken. Upon completion of the sequence, the green light shall illuminate as in normal sequential operation. The "Retrofire" sequence-warning light shall be green if all retrograde rockets have fired, or red if one or more have not fired. The "Reserve Deploy" panel shall consist of an engraved nameplate of aluminum material, with white nomenclature on a black background. R-1

A single-pole "on-off" toggle switch for testing the warning lights shall be located directly above the override controls.

Two amber lights shall be provided on the outer left hand console panel for retrograde rocket heater "on" warning and for retrograde rocket "cold" warning.

3.8.4.4.2 Displays indicated by the telelight system on the main instrument panel shall be as follows:

Recording (Green)

Mayday (Red)

Launch Control "Ready" (Green)

O_2 Warning (Amber)*

Standby D.C.-Auto (Amber)

Standby A.C.-Auto (Amber)

O_2 Emergency Flow (Amber)*

* These lights in capsule, but shall not be energized because of inoperative environmental control system.

3.8.4.5 DEAD RECKONING EARTH PATH INDICATION - A dead reckoning earth path indicator, MAC No. 45-81722-3, shall be provided in the instrument panel to the right of station line X0.00 and above the periscope display. This indicator shall be a spring-driven unit requiring no electrical power and shall display the earth path by use of a gimballed globe approximately 3.85 inches in diameter. The globe (earth) shall rotate in a manner such that the location of the capsule relative to ground position appears beneath an index point in the center of the display. Touchdown point on orbital flights shall be indicated by an arrow which shall point to a white index point located within a parallelogram on the lower portion of the indicator. Control knobs shall be provided for alignment of the earth path to the view indicated on the periscope. Control knobs shall be provided for "orbit E.W.", "polar E.W.", "orbit time", "wind", and "inclination degrees". R-1

3.8.4.6 SWITCHES AND HANDLES - The following switches and handles with their respective nomenclatures and functions shall be located on the instrument panel and left hand console (excluding telelight warning and sequence panel override switches):

TYPE	FUNCTION	NOMENCLATURE	
Toggle Sw.	Fly-By-Wire - Aux. Damping - Normal	ASCS Mode Selection (P-19)*	
Toggle Sw.	Cage - Free - Normal	ASCS Gyro	Left Hand
Toggle Sw.	On - Off	Cabin Lights	Console
Toggle Sw.	Dis-Arm-Arm	Auto Retro Jettison (P-9)	
Toggle Sw.	On - Off	Retro Heater	
Toggle Sw.	On - Off	Signal Lights Test	

* This switch in capsule, but serves no function since there is no "Fly-By-Wire" mode in ASCS in Capsule No. 2.

3.8.4.6 SWITCHES AND HANDLES - (Continued) R-1

TYPE	FUNCTION	NOMENCLATURE	
"T" Handle	Pull Open - Only Below 20,000 Feet	Warning-Snorkel	Left Hand
Toggle Sw.	Contin.-Grnd. Cmnd.	Beacon (P-17)	
Toggle Sw.	Arm - Off	Squib	
Toggle Sw.	Auto. - Man. On	Rate Indicator	
Toggle Sw.	Norm. - Off	Cabin Fan	
Toggle Sw.	Norm.-No. 1-No. 2	Suit Fan	
Toggle Sw.	Auto. - Man.	Standby Batt.	
Toggle Sw.	Norm.-Emerg. Fans ASCS	Emergency A.C. Power	Instrument Panel
Toggle Sw.	UHF-Off-HF	Transmit	
Toggle Sw.	Norm.-Reserve	UHF Select (P-22)	
Toggle Sw.	Norm. - Standby	Isolated Batt.	
Toggle Sw.	Norm. - ASCS Off	Elec. Power (P-18)	
Toggle Sw.	Norm-Off-Emerg.	Ammeter	
Toggle Sw.	Fans - ASCS	A.C. Volts	
Toggle Sw.	Fans Only-ASCS Only	Standby Inverter (P-18)	

Switch numbers (P-1, etc.) correspond to those indicated in the sequential schematic, Figure 4, Page 43.

3.8.4.6 SWITCHES AND HANDLES - (Continued)

TYPE	FUNCTION	NOMENCLATURE		
Toggle Sw.	Norm. - Emerg.	Audio Bus	Instrument Panel	R-1
Toggle Sw.	Ready - Off	Launch Control (P-1)		
Rotary Sw.		Voltmeter Selection		
Toggle Sw.	Contin.-Grnd. Cmnd.	Hi-Watt Telemetry (Low-Freq)*		

* This switch shall serve no function, since low frequency telemetry shall be energized by an instrumentation mode relay on unmanned capsules.

Switch numbers (P-1, etc.) correspond to those indicated in the sequential schematic, Figure 4, Page 43.

3.8.5 LIGHTING - Lighting for the cabin instruments and instrument camera shall be a dual A.C. system utilizing floodlights located in the pressurized area. The cabin lights shall be turned "on" or "off" by a switch located on the left-hand console. Two white flourescent lamps, MAC No. 45-79738-1, each providing 4 watts illumination, shall be provided.

3.9 CAPSULE ENVIRONMENTAL CONTROL -

3.9.1 ENVIRONMENTAL CONTROL SYSTEM - The environemental control system installed in Capsule No. 2 shall be as tabulated in Appendix I-C, Item 8 herein. The system shall be functionally inoperative with the exception of the cabin equipment blower. During the pre-launch operation, Freon 114 refrigerant shall be introduced into the cabin heat exchanger via the umbilical for cooling cabin equipment. The cabin equipment blower shall circulate the air around equipment until re-entry, at 20,000 feet altitude, when it shall be de-energized automatically as depicted on the sequential schematic, Figure 4, page 43.

Cabin pressure shall be approximately equal to ambient atmosphere pressure to a cabin altitude of 27,000 feet during the launch phase when the cabin pressure regulator valve automatically shall close. Upon re-entry, this valve automatically shall re-open at 27,000 feet altitude. At 20,000 feet altitude, the snorkel valves shall open and the cabin fan shall be de-energized.

3.10 STABILIZATION CONTROL SUBSYSTEM - The stabilization control subsystem shall consist of the automatic stabilization and control system, the horizon scanners and the reaction control system. The launch trajectory control and guidance shall be considered an integral part of the launching missile system and shall not be the responsibility of the capsule contractor.

3.10.1 AUTOMATIC STABILIZATION AND CONTROL SYSTEM - The automatic stabilization and control system (ASCS) as defined in McDonnell Drawing No. 45-87700-303 (assembly as tabulated in Appendix I-C, Item 5 herein) shall provide automatic stabilization and orientation of the capsule from time of separation from the booster adapter until landing parachute deployment in accordance with the various phases of the mission. The ASCS shall supply output signals for display, recording and telemetering of three axis attitude information, a discrete signal at 0.05g longitudinal acceleration during re-entry, and an attitude signal sector for use in the capsule retrograde firing interlock circuit. Associated equipment consisting of the horizon scanners, reaction controls, communication system telemetry, indicator for display of the capsule attitude and angular rates in 3 axes, and sensors for generating capsule signals for discrete mission events, shall be utilized by the ASCS. The expenditure of propellant in limit cycle oscillations shall be minimized by the design of the control system.

The ASCS shall include rate gyros for sensing capsule rotational rates and an attitude reference system consisting of a vertical and a directional gyro which (with inputs from the horizon scanners) shall sense roll, pitch and yaw attitudes; and, a 0.05g longitudinal accelerometer for initiation of the re-entry mode. Prior to launching, the vertical and directional gyros (roll gimbal only) shall be torqued so as to erect the spin axes to any orientation desired relative to the launch trajectory. During the final portion of the climb phase to tower separation, the vertical gyro spin axis shall be erected to the horizon scanners. Following tower separation, during the coast phase until retrograde assembly jettison, the vertical gyro shall be slaved to the horizon scanners. R-1

3.10.1.1 MODES OF OPERATION - The ASCS shall have four modes of automatic operation. These shall be damper mode, orientation mode, attitude-hold mode, and retrofire and re-entry mode.

3.10.1.2 SEQUENCE OF OPERATION - The following general sequence of operation shall be provided by the ASCS.

a. Rate damper operation in early abort cases.

b. Rate damping and orientation to desired attitude in later aborts or in normal ballistic missions.

3.10.1.2 SEQUENCE OF OPERATION - (Continued)

c. Orientation with respect to the local earth vertical.

d. Capsule alignment to specified pitch angle just prior to retrograde rocket firing.

e. Retain capsule orientation during retrograde rocket firing.

f. Capsule reorientation to selected re-entry attitude after retrograde rocket firing.

g. Switching to rate damper mode at longitudinal acceleration (from drag buildup) of 0.05g and providing a steady roll of approximately 10 to 12 degrees per second thereafter.

h. Disengagement when landing chute deploys.

3.10.2 HORIZON SCANNER SYSTEM - A horizon scanner system in accordance with MAC Drawing No. 45-87702 shall be provided for sensing roll and pitch attitude reference for the ASCS. The horizon scanner system shall consist of two scanner units MAC No. 45-87702-3; one unit aligned to the pitch axis, and one unit aligned to the roll axis. The scanner units shall be body mounted to structure within the antenna fairing assembly, and shall provide a 118 degree conical scan of the horizon through a rotating prism located ahead of the scanner lens. The prism shall rotate at a speed of approximately 30 revolutions per second. Each scanner unit shall receive A.C. power inputs through the capsule A.C. power system and shall supply direct current output signals of the required polarity to provide the roll and/or pitch signals up to a maximum of 35 degrees for torquing the attitude gyros in the ASCS. Yaw sensing shall be achieved through torquing of vertical and directional gyros of the ASCS by horizon scanner roll signal inputs. The scanners shall be energized at time-zero and shall function continuously from tower separation when the ASCS vertical attitude gyro shall be slaved to the scanners to retrograde jettison when the scanners shall be de-energized. This shall amount to approximately 4 minutes operating time during the mission defined in Paragraph 1.1.1 herein.

3.10.3 REACTION CONTROL SYSTEM - The reaction control system in accordance with MAC Drawing No. 45-61700 (-11 assembly per Appendix I-C herein, Item 6), shall consist of an automatic control system and a portion of the manual control system. The reaction control system shall provide control of the capsule in the roll, pitch and yaw axes. This system shall be a pressure-fed, monopropellant/catalyst bed design, incorporating right angle firing exhaust nozzles, which shall produce thrust through decomposition of hydrogen peroxide (H_2O_2). Minimal translational motions may result upon application of reaction control thrust.

3.10.3.1 AUTOMATIC CONTROL SYSTEM - The automatic control system and the manual control system (as described in Paragraph 3.10.3.2), which together comprise MAC No. 45-61700-11, as provided in Capsule No. 2, shall consist of six hydrogen peroxide monopropellant thrust chambers of fixed thrust levels and their associated valves, lines, tanks, pressure regulator, and pressurization bottles. The automatic control system can be essentially divided into three (3) sections: Pressurization and fuel supply, distribution, and propulsion units. The fuel supply shall be nonstable hydrogen peroxide (H_2O_2) contained inside a flexible bladder which in turn shall be contained in a half toroidal tank. This system shall function automatically in conjunction with the automatic stabilization and control system. Sufficient H_2O_2 and He shall be provided to maintain damper operation until after main parachute deployment. R-1

3.10.3.2 MANUAL CONTROL SYSTEM - That portion of the manual control system applicable to and installed in Mercury No. 2 capsule shall consist of the He system only. The He line shall be capped at the point where the He line would normally join the H_2O_2 tank. R-1

3.10.3.3 OPERATION - Prior to launch, the helium regulator manual shutoff valve shall be opened, allowing high pressure helium (He) gas to pass through the filter, regulator, check valve, and finally, to surround and pressurize the flexible bladder. The helium pressure shall force the H_2O_2 out of the bladder through the perforated transfer tube and into the downstream lines. The manual shutoff valves shall be opened prior to launch permitting the H_2O_2 to be available at the electrically operated solenoid shutoff valves. Upon receiving at 24 V D.C. signal from the ASCS, the appropriate solenoid valve opens. H_2O_2 passes into the corresponding thrust chamber where it shall be decomposed and shall provide the following thrust levels for operation with the ASCS:

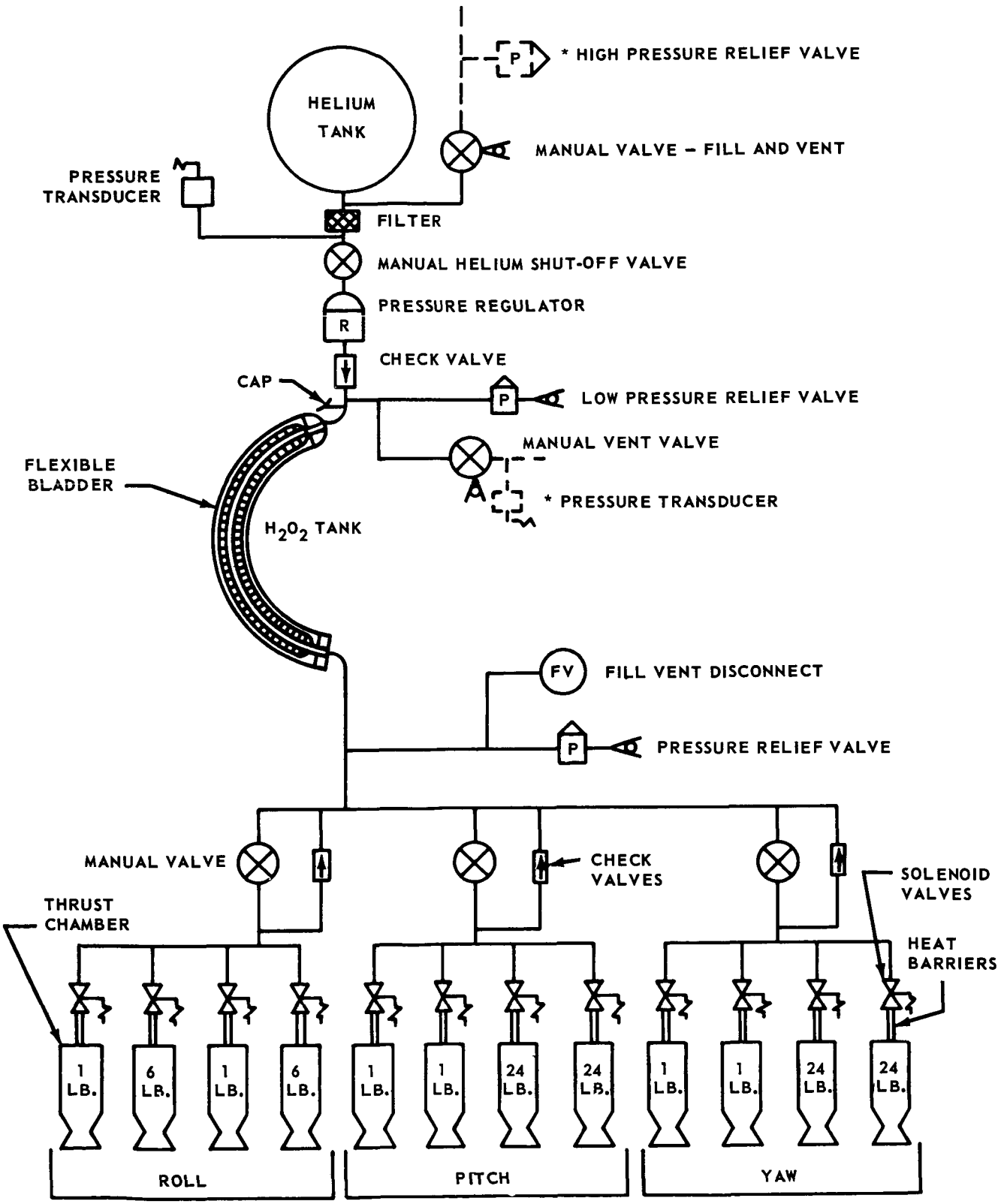
a. High thrust level of twenty-four (24) pounds for pitch and yaw axes and six (6) pounds for the roll axis.

b. Deleted R-1

These thrust levels shall be available in discrete, short time period outputs in the orbit mode and in steady thrust levels in damper, orientation and retrofire modes as controlled by the ASCS.

The helium pressure transducer shall provide a means of monitoring (by proper calibration) the percentage of H_2O_2 present in the bladder. The perforated tube in the propellant tank (contained in the bladder) shall be used to prevent the possibility of trapping helium pressure while servicing the H_2O_2 bladder.

3.10.3.4 TANKS - The helium tanks for the reaction control system shall be located in the cabin and shall be of spherical fiberglass construction. These tanks shall store the H_e at 2250 psi and the automatic control system tank shall pressure feed to the H_2O_2 tank at 450 psi. The H_2O_2 tank shall be a half-toroidal configuration contoured to mount on the aft pressure bulkhead between the bulkhead and the heat sink. The H_2O_2 tank shall be constructed of aluminum insulated to provide temperature control and incorporate a flexible plastic bladder to provide pressure for positive expulsion of the H_2O_2. Provisions for in-flight jettisoning of H_2O_2 after main parachute deployment shall be provided. R-1

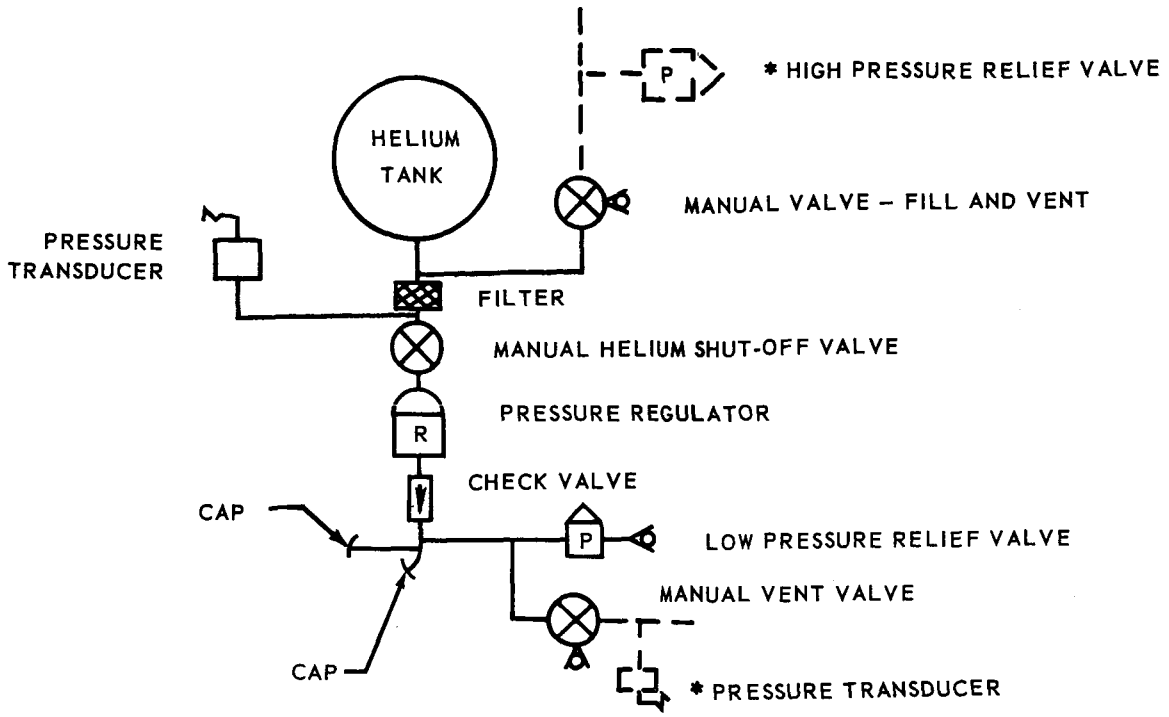


FOLD-OUT #1

AUTOMATIC SUBSYSTEM

FIGURE 3

[redacted]



MANUAL SUBSYSTEM

NOTE: * INDICATES COMPONENT WILL BE FURNISHED ON GROUND SUPPORT EQUIPMENT

FOLD-OUT #2

3.11 RETROGRADE ROCKET SYSTEM

3.11.1 DESCRIPTION - The re-entry phase of the MR-1 mission shall be initiated by firing of a retrograde rocket system consisting of three Thiokol Model TE-316 solid propellant rockets, MAC No. 45-50700-13 and associated components as specified in Appendix I-C, Item 2.1 herein. The target value for magnitude of the retroimpulse shall be to provide a velocity decrement of approximately 500 feet per second for the capsule weight as specified in Paragraph 3.1.1.7. These rockets shall have a total vacuum impulse of approximately 13,000 pound seconds providing 992 pounds of thrust each for 13.2 seconds under the conditions specified in MAC Drawing No. 45-50700.

3.11.2 INSTALLATION - The retrograde rocket assembly shall be mounted on a structural frame encased within an insulated aluminum alloy housing which shall be secured external to the heat sink by retaining straps. The retaining straps, MAC No. 45-72030-301, shall be attached to the capsule by retention fittings, MAC No. 45-32086-1, which remain engaged only as long as tension exists in the straps, and to the rocket structural assembly by a centrally located explosive bolt, MAC No. 45-72704-9. Jettison of the retrograde rocket assembly shall be effected by release of the retaining straps by firing of the explosive ejector bolt, removing tension from the retaining straps, and permitting a compression spring jettison assembly, MAC No. 45-50013-901, to thrust the retrograde assembly from the capsule. Initiation of the ejector bolt shall be through a firing command latching signal which shall bypass the retrofire sequencing sensor permitting retrograde rocket assembly separation after a 60 second time delay even though one or none of the rockets has fired. The rockets and rocket nozzles shall be shielded by cover assemblies, MAC No. 45-50012-1, for protection against meteorite penetration. These covers shall blow off as the rockets fire. The rocket assembly housing shall be finished with a paint possessing sufficient solar absorptivity characteristics to provide a relatively warm environment within the enclosure. Provision shall be made within the housing to insure proper temperature control by inclusion of a heater assembly, MAC No. 45-50702-11, and thermostat assembly, MAC No. 45-79705-11, in each rocket installation, as well as thermoflex insulation. Rocket thrust direction shall be aligned on the ground prior to launch so as to minimize eccentricity between the thrust vector and the capsule center of gravity.

3.11.3 IGNITION - Automatic sequencing of the retrograde operation shall be initiated by a predetermined t_r signal from the clock or by a ground command signal via the command receivers and decoders (see Paragraph 3.14.2). The initiating signal from the clock shall command the ASCS to assume the required -34 degree retrograde attitude and energize a 30 second time delay relay. The command signal shall cause "Attitude Permission" relays to become energized, completing a circuit to the 30 second R-1

3.11.3 IGNITION - (Continued)

time delay relay. Upon runout of the 30 second time delay, if the commanded retrograde attitude of -34 degrees is correct, a firing signal shall be transmitted to the retrograde rocket firing relays. The rockets shall be sequentially fired at 5 second intervals with the bottom, left and right rockets firing in that order. Simultaneous with initiation of the rocket firing signal, a signal shall be transmitted to a time delay relay which shall apply a "Retrograde Fire" signal to the ASCS for 30 seconds. Jettison of the retrograde rocket installation shall be initiated as described in Paragraph 3.11.2. R-1

3.11.4 POSIGRADE ROCKET SYSTEM - A posigrade rocket system shall be provided to aid in separation of the capsule and booster in both normal and abort missions. This system shall consist of three (3) Atlantic Research Corporation solid propellant rockets, MAC No. 45-50701-3. (See Appendix I-C, Item 1.2.) These rockets shall have a total vacuum impulse of 475 pound seconds each providing an average thrust of 370 pounds each for an action time of 1.35 seconds under the conditions specified in MAC Drawing No. 45-50701. Firing of the posigrade rockets shall produce a separation velocity of 32 feet per second under the conditions specified in MAC Drawing No. 45-50701. The posigrade rockets shall be symmetrically mounted in the retrograde rocket assembly housing between the retrograde rockets. Posigrade rocket system initiation shall be accomplished automatically through a separation signal from the capsule-adapter ring separation sensor after the capsule-adapter clamp ring explosive bolts fire. (See Paragraph 3.12.5.) R-1

3.12 ESCAPE SYSTEM - An active escape system shall be provided as part of the capsule. This system shall be capable of functioning prior to tower separation should it be necessary to abort a mission and escape from the vicinity of the Redstone missile system. Escape sequence prior to and after release of the active escape system for either a normal or aborted Redstone mission shall be as specified in Paragraph 3.12.5. R-1

3.12.1 DESCRIPTION - The escape system shall consist of a pylon framework supporting an escape rocket assembly, MAC No. 45-51002-303, a pylon jettison rocket MAC No. 45-51701-3, an aerodynamic spike, MAC No. 45-51017-1, and ballast assembly, MAC No. 45-51010-301. The pylon shall be a tower structure consisting of 3 longitudinal members of tubular steel construction diagonally braced and shall incorporate an antenna cover assembly for shielding the antenna fairing. (See Paragraph 3.5.7.) The pylon shall be attached to the capsule nose assembly by a clamp ring assembly consisting of 3 segmented sections joined by 3 explosive tension bolts. Two explosive bolts can be initiated electrically from either end by a dual electrical system. The third explosive bolt may be initiated electrically from one end only. Initiation of the explosive bolts for a clamp ring separation shall be as described in Paragraph 3.12.5. A 45° aerodynamic fairing shall be installed over the pylon clamp ring to reduce the pylon ballast weight and to facilitate greater aerodynamic stability of the capsule prior to tower separation. R-1 R-1 R-1

3.12.2 ESCAPE ROCKET - The escape rocket, MAC No. 45-51700-3, shall be supported by the tower structure, and the aerodynamic spike and ballast assembly shall be secured to the escape rocket structural assembly. The escape rocket shall consist of a solid propellant rocket motor with 3 nozzles canted 19 degrees from the longitudinal axis of the rocket case and an electrically actuated igniter. The nominal action time for the escape rocket shall be 1.39 seconds with an average resultant thrust of 41,500 pounds at its center line. Nominal thrust impulse rating of this rocket shall be 56,500 pound-seconds, under conditions specified in MAC Drawing No. 45-51700.

3.12.3 PYLON JETTISON ROCKET - The pylon jettison rocket, MAC No. 45-51701-15, shall be supported by the escape rocket structural assembly. This rocket shall be symmetrically mounted on the escape rocket longitudinal axis between the canted nozzles. The pylon jettison rocket shall consist of a solid propellant rocket motor, with three (3) nozzles, each canted nineteen (19) degrees from the longitudinal axis, and an electrically actuated igniter. The nominal action time for this rocket shall be 1.6 seconds with an average resultant thrust of 765 pounds, under the conditions specified in MAC Drawing No. 45-51701. R-1 R-1

3.12.4 ESCAPE SYSTEM PERFORMANCE - The escape system in an escape from the ground launching pad shall propel the capsule to an altitude of approximately 2200 feet. Determination of the nominal escape rocket thrust eccentricity shall be the result of rational analysis which will attain a reasonable compromise between adequate capsule-booster separation distance and structural lateral load factor characteristics. The analysis shall consider effects such as: R-1

a. Capsule abort conditions as a result of booster malfunction.

b. Booster flight characteristics subsequent to capsule-adapter separation.

c. Capsule escape rocket thrust eccentricity tolerance.

The determination of booster flight conditions leading to the initiation of the abort maneuver and following capsule separation shall not be the responsibility of the capsule contractor.

3.12.5 ESCAPE SYSTEM SEQUENCE - Escape system sequence for normal or aborted missions shall be as specified in the following paragraphs.

3.12.5.1 NORMAL MISSION (REDSTONE) - Normal sequence for the mission defined in Paragraph 1.1.1 shall be as described below. (See Sequential Schematic, Figure 4, Page 43).

a. At booster liftoff, the following shall occur:

1. The booster failure detection system shall be activated.

2. A time zero reference established in the capsule clock.

3. A time zero reference established in the capsule maximum altitude sensor and recording equipment.

b. At booster cutoff the following shall occur: (T-0 + 140.50 Seconds) R-1

1. A 10 second time delay shall be energized.

3.12.5.1 NORMAL MISSION (REDSTONE) - (Continued)

2. Contacts in a control relay shall be closed for electrical initiation of the tower clamp ring explosive bolts, which after firing, permit separation of the clamp ring segments. R-1

3. A tower ring separation sensor (limit switch) shall transmit a clamp ring separation signal to ignite the escape rocket and tower jettison rocket, and arm the landing system (see Paragraph 3.17.1).

4. At runout of the 10 second time delay, after receipt of a separation signal from the tower separation sensor, a power and control relay shall transmit a separation signal to an accelerometer type thrust cutoff sensor. The thrust cutoff sensor shall sense booster loss of thrust to 0.20g at which condition the sensor shall electrically initiate the capsule-adapter clamp ring explosive bolts to permit separation of the clamp ring segments. R-1

c. At capsule-adapter clamp ring separation (T-0 + 150.50 seconds), the following shall occur: R-1

1. A capsule-adapter ring separation sensor (limit switch) shall fire the posigrade rockets for separation between the capsule and booster-adapter complex and extend the periscope. R-1

2. The capsule-adapter separation sensor shall arm the clock, start the damping signal 5 second timer and energize the damping signal relay, which shall command the damping mode of the ASCS. R-1

3. After runout of the 5 second time delay, (T-0 + 155.50 seconds), the orbit orientation mode of the ASCS shall be commanded (-14.5 degrees attitude with heat sink forward and up). R-1

d. At retrograde time-to-go, the following shall occur:

(T + 290.3 seconds) R-1

3.12.5.1 NORMAL MISSION (REDSTONE) - (Continued)

1. The clock shall command the ASCS to assume the retrograde attitude, arm the retrointerlock (attitude permission) switch in the ASCS and start a 30 second timer. R-1

2. After 30 seconds, the 30 second time delay relay, in series with the attitude permission relay shall apply a signal for firing of the retrograde rockets (T + 320.3 seconds). R-1

3. At the same time as the retrograde firing signal is applied, another 30 second time delay relay shall be energized, and a "retrograde fire" signal applied to the ASCS for the 30 second period. The capsule shall be held in the retrofiring position from T-0 + 320.3 to T-0 + 380.3 seconds by use of these two relays. Firing and jettison of the retrograde assembly shall be as described in Paragraphs 3.11.2 and 3.11.3. R-1

4. At retrograde assembly jettison (T-0+380.3 seconds), the retro attitude command shall be removed, and a re-entry orientation mode commanded for conditions below 0.05g. A 5 second time delay relay shall be energized, which upon runout, shall arm the ASCS accelerometer for sensing capsule conditions greater than 0.05g for re-entry stabilization, until drogue chute deployment. Landing system sequence shall be as described in Paragraph 3.17.1. R-1

3.12.5.2 ABORTED MISSIONS - Mission aborts may occur either off the pad and prior to tower separation or after tower separation. Abort indication shall be provided within the capsule by a red MAYDAY telelight located on the main instrument panel above the periscope display.

3.12.5.2.1 ABORT INITIATION - An abort shall be initiated by application of a 28 volt signal to the abort junction in the escape system network. Upon receipt of an abort signal, the 28 volt source shall be instantly "locked in" at this junction and shall provide the required abort sequence, consistent with the mode in which the abort maneuver is necessary. Capsule abort command will not give a booster engine shutoff prior to T + 30 seconds. The booster abort command will be stored and shall give an engine cutoff command at T-0 + 30 seconds. Mission aborts may be initiated under any of the following conditions:

3.12.5.2.1 ABORT INITIATION - (Continued)

a. Prior to capsule umbilical separation, an off the pad abort may be initiated from the blockhouse.

b. After capsule umbilical separation and prior to missile liftoff (3/32 inch altitude), an abort can be initiated by radio command and by hard line which bypasses the missile lockout relay via the missile umbilical.

c. After missile liftoff, prior to missile umbilical separation, an abort can be initiated by radio command, by hard line via missile umbilical and by the missile auto-abort system.

d. After missile umbilical separation and prior to booster cutoff, an abort can be initiated by radio command and by the missile auto-abort system.

e. After booster cutoff, an abort can be initiated by radio command.

3.12.5.3 ABORT SEQUENCE OFF THE PAD AND PRIOR TO TOWER SEPARATION - Upon receipt of an abort sequence from any one of the sources outlined in Paragraph 3.12.5.2.1, the capsule "MAYDAY" light shall be illuminated, a booster engine cutoff command sent to the booster and the capsule-adapter clamp ring explosive bolts fired through the "TWR NOT SEP" contacts of the tower separation sensor relay, permitting separation of the clamp ring segments. A capsule adapter ring separation sensor shall detect this separation and shall initiate firing of the escape rocket which shall propel the capsule from the path of the booster. Simultaneously, the capsule adapter ring separation sensor shall energize the tower separation abort interlock relay (through the "TWR NOT SEP" contacts of the tower separation sensor) which shall command the rate damping mode of the ASCS and also fire the retrograde rocket assembly ejector bolt for separation of the assembly. The retrograde assembly separation sensor shall energize a 5 second timer which shall arm the ASCS accelerometer switch for sensing of capsule conditions greater than 0.05g and to provide capsule stabilization. Capsule-adapter separation shall be detected by the capsule adapter separation sensor relays which provide an interlock for the output of the maximum altitude sensor (time versus time computer). The maximum altitude sensor shall compute a time delay for abort tower separation versus real time beginning at time zero. This delay shall permit the capsule to reach a safe dynamic pressure before jettisoning the escape tower. R-1 R-1

3.12.5.3 ABORT SEQUENCE OFF THE PAD AND PRIOR TO TOWER SEPARATION - (Continued)

The time delay (ΔT) for tower separation with relation to time of abort (T_A) after time zero, shall be as follows:

$$\Delta T, \text{ Sec.} = 0.1855\ T_A + 7.0 \qquad 0 \leq T_A$$ R-1

The maximum altitude sensor output shall initiate firing of the tower clamp ring explosive bolts, separating the clamp ring segments. Tower clamp ring separation shall be detected by a tower clamp ring separation sensor which shall initiate firing of the tower jettison rocket which shall separate the tower from the capsule. A tower separation sensor shall transmit a separation signal which shall start a 3 second timer which upon runout, shall arm the landing system, 21,000 feet dual barostat and 10,000 feet dual barostat. R-1 R-1

3.12.5.4 ABORT SEQUENCE AFTER TOWER SEPARATION - An abort after tower separation can occur up to retrograde time-to-go (T-0 + 290.3 seconds). This can be initiated by ground command abort signal G-1 or by ground command G-5. Following capsule separation, the abort signal from ground command abort signal G-1 shall cause the "MAYDAY" light to become illuminated, supply a 5 second rate damping signal to the ASCS and energize the "Retro-attitude" command relay which shall cause the stabilization and control system to position the capsule in the retrograde attitude. Retrograde can then be initiated by ground command G-5. The sequence shall parallel that of a normal Redstone mission as defined in Paragraph 3.12.5.1, subparagraphs d2, d3 and d4, except for reference times from time zero. R-1 R-1

SEQUENTIAL SCHEMATIC

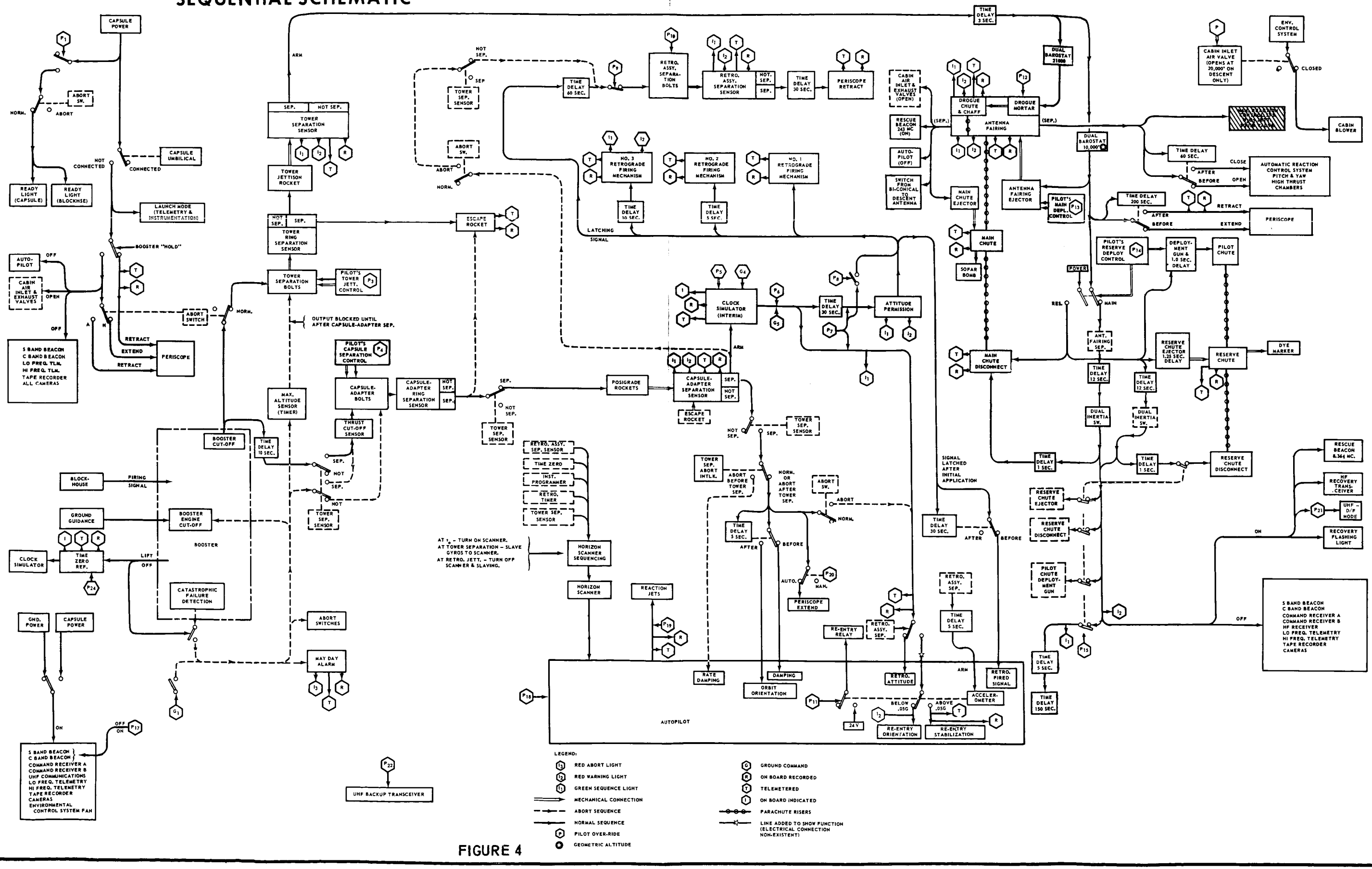


FIGURE 4

R-1

3.13 ELECTRICAL POWER SUPPLY SYSTEM - The electrical power supply system shall consist of 6 batteries which comprise the main, standby and isolated power supplies. Inverters shall be used for conversion of D.C. power to A.C. power. The batteries shall be located between Stations RX 12.00 and RX 21.625 and LX 12.00 and LX 21.625 (three on each side) at Station Z 113.50. All batteries shall have individual diode reverse current protection for prevention of unnecessary power consumption because of a weak or faulty battery. Each battery shall be sealed at sea level pressure to withstand a pressure of 14.7 psi both internally and externally, and shall have a pressure relief valve for maintaining internal pressure between 5 psi and 14.7 psi as required. The batteries shall be vented for release of gas only with vent lines passing through the large pressure bulkhead and terminating in the capsule skin just aft of the bulkhead, such that the gas vents overboard. No D.C. voltage monitoring shall be provided although voltage available shall be indicated by the D.C. voltmeter located on the main instrument panel. Electrical loads shall be categorized as essential and nonessential and applied through separate busses through separate fuse panels. In event of low battery voltage, the nonessential bus automatically shall be switched "off". The D.C. power control system shall be as depicted in Figures 5a and 5b, Pages 47 and 48. R-1

3.13.1 MAIN POWER SUPPLY - The main power supply shall consist of three 3000 watt/hour silver zinc batteries, MAC No. 45-79707-17, and one 1500 watt/hour silver zinc battery, MAC No. 45-79707-19. (See Appendix I-C, Item 4 herein for electrical components.) Terminal voltage of these batteries shall average approximately 24 volts with a maximum of 29.6 volts and a minimum of 18 volts. The main batteries shall be wired in parallel with power inserted or withdrawn from the parallel circuit by an adjacent "on-off" switch. The main batteries shall be capable of providing power requirements for the mission as defined in Paragraph 1.1.1 herein. One of the 3000 watt/hour batteries (see Figure 5a) shall provide power for the special instrumentation required for the MR-1 mission. R-1

3.13.2 STANDBY POWER - The standby power supply MAC No. 45-79707-19 shall consist of one 1500 watt/hour silver zinc battery with voltage taps of 24, 18, 12 and 6 volts. The standby battery shall have capacity sufficient to provide power to capsule equipment for the duration of the flight plus 5.0 hours for post landing components. Selection of automatic operation shall be made by a switch provided on the main instrument panel (see Paragraph 3.8.4.6) prior to launch. Selection of automatic mode shall insert standby power into the main power supply system should a failure or low voltage occur. A standby DC warning light shall become illuminated at this time and all nonessential loads deprived of power. The standby system shall automatically continue to supply power to essential loads. The standby battery shall have sufficient capacity to provide a power source for the rescue beacon and rescue voice communications.

3.13.2.1 ISOLATED POWER - The isolated power supply, MAC No. 45-79709-19, shall consist of one 1500 watt/hour silver zinc battery with voltage taps of 24, 18, 12 and 6 volts. The isolated battery system shall have sufficient capacity to provide power to the pyrotechnic actuated devices (see Paragraph 3.20). The isolated battery shall supply power to the audio bus for rescue communications if the audio bus switch is placed in the "Emerg" position prior to launch on unmanned capsules. Isolated battery power shall be inserted into the standby battery circuit if the isolated battery switch is placed in the "Standby" position prior to launch.

3.13.3 A.C. POWER SYSTEM - The A.C. power system shall consist of two main and one standby static inverters and filters, for conversion of 24 volt D.C. power to 115 volts, single phase, 400 cycles A.C. power.

3.13.3.1 MAIN A.C. POWER SYSTEM - The main A.C. power system shall consist of one 250 VA static inverter, MAC No. 45-79709-1 and one 150 VA static inverter, MAC No. 45-79709-3. The 250 VA inverter shall be mounted on the outboard side of Station LX 21.625 above Station Y0.00 and the 150 VA inverter shall be mounted on the outboard side of Station LX 12.00 below Station Y0.00. The 250 VA inverter shall supply A.C. power to the ASCS, horizon scanners, rate indicating system and humidity indicator and cabin lights. The 150 VA inverter shall supply A.C. power to the environmental control system cabin fan. The inverters shall supply A.C. power as specified during the launch, coast and re-entry phases until 0.05g at which point, the 150 VA inverter shall supply power to the ASCS, etc. and the 250 VA inverter shall supply power to the cabin fan.

3.13.3.2 STANDBY A.C. POWER - The standby A.C. power system shall consist of one 250 VA static inverter, MAC No. 45-79709-1. The standby inverter shall be mounted on the outboard side of Station LX 21.625 above Station Y0.00. The standby inverter shall supply A.C. power to the ASCS or cabin fans, dependent upon the position of the standby inverter switch. If the switch has been placed in the "Auto" position, and a compound main inverter failure should occur, the cabin fans shall be supplied A.C. power from the standby inverter. Upon failure of either of the main inverters, the appropriate circuit shall be de-energized and the standby inverter shall supply A.C. power to the equipment formerly powered by the main inverter.

3.13.4 ELECTRICAL CONNECTIONS - Design of the electrical system shall be such that there shall be no exposed electrical connections within the capsule to allow shorting by corrosive atmosphere and floating debris.

3.13.4.1 UMBILICAL CONNECTIONS - In order to maintain a fully charged condition on the batteries and to provide power for ground testing of various systems within the capsule, external power shall be supplied to the capsule prior to launching through an umbilical cable and

3.13.4.1 UMBILICAL CONNECTIONS (Continued)

disconnect assembly, MAC No. 45-79723-1. This cable shall be attached to the capsule mating receptacle through the open periscope door in accordance with MAC Drawing 45-00796. The umbilical coupling device shall afford a secure and a positive connection at the capsule, capable of being released both electrically by a solenoid release mechanism and manually by a lanyard release as specified on MAC Drawing 45-79723.

It shall be the responsibility of the umbilical connection to provide for the transfer of Freon 114 to the capsule at such a rate and manner as specified on MAC Drawing 45-79723.

SWITCH	POSITION	OPERATION
●	OFF	MAIN 1500 WH. BATTERY OFF.
	ON	MAIN 1500 WH. BATTERY ON, SW. ● PERMITTING.
●	OFF	MAIN 3000 WH. BATTERY "A" OFF.
	ON	MAIN 3000 WH. BATTERY "A" ON, SW. ● PERMITTING.
●	OFF	MAIN 3000 WH. BATTERY "B" OFF.
	ON	MAIN 3000 WH. BATTERY "B" ON, SW. ● PERMITTING.
●	OFF	MAIN 3000 WH. BATTERY "C" OFF.
	ON	MAIN 3000 WH. BATTERY "C" ON, SW. ● PERMITTING.
●	OFF	STDBY. 24V OFF.
	ON	STDBY. 24V AVAILABLE, SW. ● PERMITTING.
●	OFF	ISOL. 24V OFF.
	ON	ISOL. 24V AVAILABLE, SW. ● PERMITTING.
●	OFF	ALL ELEC. PWR. OFF.
	NORM.	AMMETER READS TOTAL CAPSULE PWR., PWR. ON IF SWS. ● THRU ● ARE ON.
	EMER.	AMMETER BYPASS – PWR. ON IF SWS. ● THRU ● ARE ON.

SWITCH	POSITION	OPERATION
●	NORM.	ISOL. BATTERY NOT CONNECTED TO MAIN SYSTEM.
	STDBY.	CONNECTS ISOL. BATTERY TO STDBY. SYSTEM.
●	MAN.	STDBY. BATTERY CONNECTED TO MAIN SYSTEM.
	AUTO.	AUTOMATIC INSERTION INTO MAIN SYSTEM ON PWR. FAILURE. AT REDUCED LOAD ASCS OFF, STDBY. DC LT. (AUTO.) ON.
●	OFF	ALL SQUIBS OFF.
	ARM	PWR. AVAIL. TO FIRE SQUIBS, SWS. ● THRU ● PERMITTING.
●		REMOVED
●	FANS	ENVIRON. CONT. SYSTEM FROM MAIN OR STDBY. INV.
	ASCS	ASCS FROM MAIN OR STDBY. INV.
	AUTO.	STDBY. INV. TO ASCS OR FANS ON AC FAILURE. FAN PRIORITY IF BOTH MAIN INVERTERS OUT.
●		REMOVED

SWITCH	POSITION	OPERATION
●	FANS	READS AC VOLTS ON FAN BUS.
		READS AC VOLTS ON ASCS BUS.
	V_M	READS DC VOLTS ON MAIN BUS.
	V_S	READS DC VOLTS ON SEC. BUS.
	V_{MA}	READS DC VOLTS ON MAIN 3000 WH. BATTERY "A".
●	V_{MB}	READS DC VOLTS ON MAIN 3000 WH. BATTERY "B".
	V_{MC}	READS DC VOLTS ON MAIN 3000 WH. BATTERY "C".
	V_{MD}	READS DC VOLTS ON MAIN 1500 WH. BATTERY "D".
	$V_{STDBY.}$	READS DC VOLTS ON STDBY. BATTERY.
	$V_{ISOL.}$	READS DC VOLTS ON ISOL. BATTERY.
●	NORM.	AUDIO BUS. POWER FROM MAIN BUS.
	EMER.	AUDIO BUS. POWER FROM ISOL. BATTERY & STDBY. BATTERY WITH SW. ● PERMITTING.

SWITCH	POSITION	OPERATION

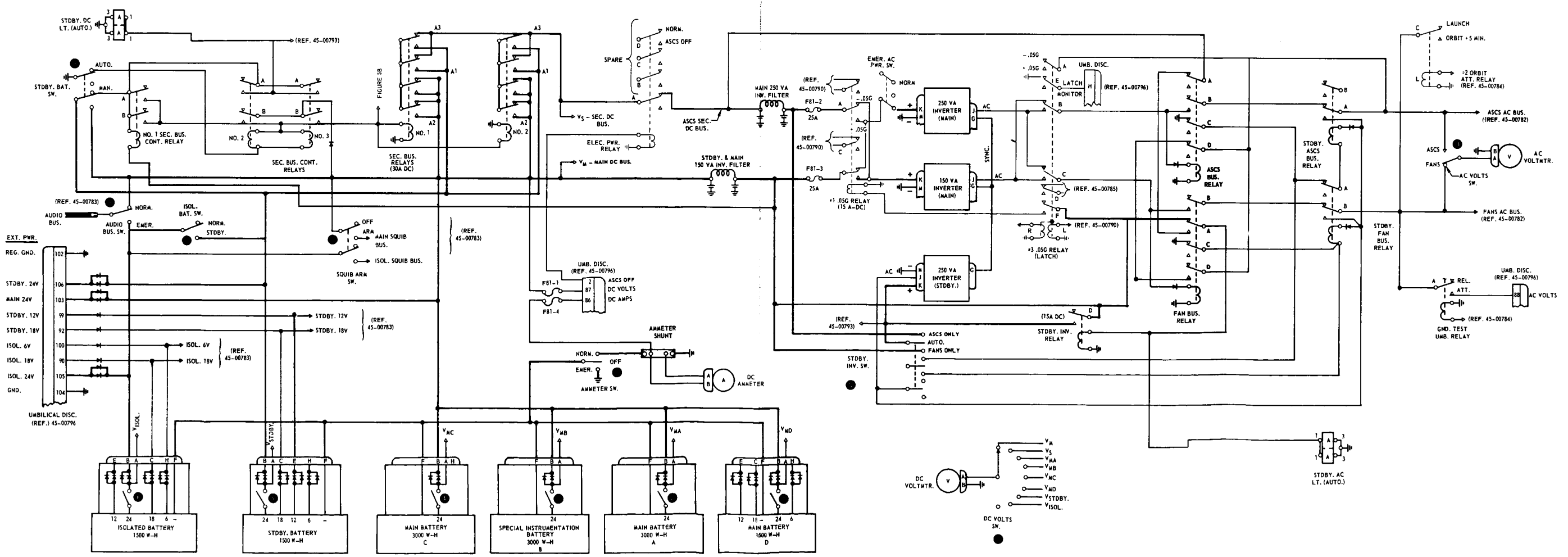
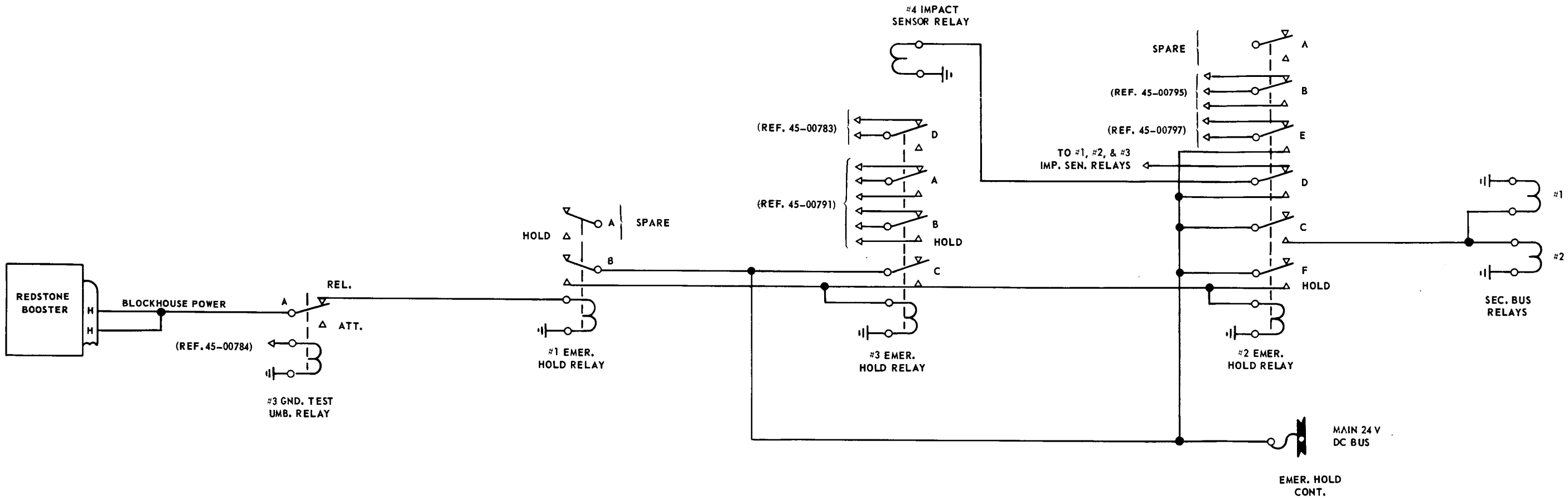


FIGURE 5A

R-1

D.C. POWER CONTROL SYSTEM SCHEMATIC



THIS SCHEMATIC REPRESENTS AN EMERGENCY "HOLD" CONDITION GENERATED THROUGH THE BOOSTER FROM THE BLOCKHOUSE AFTER UMBILICAL SEPARATION. THE "HOLD" SIGNAL SHALL BE APPLIED THROUGH THE NORMALLY CLOSED CONTACTS OF THE GROUND TEST UMBILICAL RELAY TO ENERGIZE THE NO. 1 EMERGENCY "HOLD" RELAY. ENERGIZING THE NO. 1 EMERGENCY "HOLD" RELAY SHALL APPLY POWER TO ENERGIZE THE NO. 2 AND NO. 3 EMERGENCY "HOLD" RELAYS.

ENERGIZING THE NO. 2 EMERGENCY "HOLD" RELAY SHALL ENERGIZE THE NO. 1 AND NO. 2 SECONDARY BUS RELAYS, THE NO. 4 IMPACT SENSOR RELAY, AND THE PERISCOPE EXTEND MOTOR. ENERGIZING THE NO. 3 EMERGENCY "HOLD" RELAY SHALL ENERGIZE THE SQUIB CIRCUIT FOR CABIN INLET AND OUTLET SNORKEL VENTS AND DE-ENERGIZE THE ASCS MAIN 24 D.C. BUS (SEE THE SEQUENTIAL SCHEMATIC, FIGURE 4, PAGE 43).

R-1

A

3.14 COMMUNICATIONS SYSTEM - The communications system provided aboard the Project Mercury No. 2 (MR-1) capsule shall be similar to the communications equipment provided in manned capsules, except that its operation shall be fully automatic. Capsule No. 2 communications system shall be in accordance with MAC Drawing No. 45-85700 (-311 Assembly per Appendix I-C herein, Item 7) and shall be compatible with the Atlantic Missile Range (AMR) ground station complex. The following communications systems shall be provided.

a. Two-way HF/UHF voice communications

b. Command receivers - ground to capsule

c. Telemetry equipment - capsule to ground

d. C-band radar tracking beacon

e. S-band radar tracking beacon

f. HF/UHF - Rescue beacon

g. HF rescue voice communication

h. UHF backup voice communication

3.14.1 TWO-WAY VOICE COMMUNICATIONS - The two-way voice communications system shall consist of an HF transmitter-receiver and UHF transmitter-receiver. The HF transmitter-receiver shall consist of an amplitude modulated crystal controlled unit which shall operate on a 15.016 megacycle frequency with a 5.0 watt output and 5 microvolt sensitivity for 10 db signal-to-noise ratio. This unit shall be programmed to receive only during exit and re-entry (below approximately 200,000 feet altitude) to avoid blackout of communications because of ionization disturbances. The UHF transmitter-receiver shall consist of an amplitude modulated unit which shall operate on a 299.0 megacycle frequency with a 0.5 watt power output and 3.5 microvolt sensitivity for 10 db signal-to-noise ratio (see Paragraph 3.14.4.3.2). One UHF transmitter-receiver shall be automatically keyed upon impact by the recovery system impact sensor and shall operate continuous transmission for direction finding in the recovery phase. In this capsule, the UHF select switch shall be preset in the "Norm" position prior to launch.

3.14.1.1 AUDIO CENTER - The audio center shall contain a voice controlled transmit-receive relay switch and associated circuitry to activate the selected transmitter-receiver. The threshold level of the VOX shall be field adjustable and the UHF transmitter shall be controlled by the VOX from the playback tape recorder. (See Paragraph 3.15.2.2). The unit shall contain transistorized audio amplifiers for microphone and headphone circuits, a voice filter for the command receiver and associated relays and switches.

3.14.2 COMMAND RECEIVERS AND DECODERS - Two frequency modulated transistorized command receivers similar to AN/DRW-13 receivers shall be provided. Each command system shall provide a total of 20 decoder outputs, consisting of 10 channels in each of the receivers and 10 channels in each of the two decoders provided. Each command receiver shall operate on a frequency of 414.0 megacycles and shall be compatible with FRW-2 ground command transmitters. The receivers shall have a 5 microvolt sensitivity for simultaneous five (5) channel operation. The units shall have decoder provisions for the retrograde rocket and satellite clock commands. The command receivers shall accept and decode the following commands: 1) abort (G-1); 2) satellite clock reset (G-4); and, 3) retrograde rocket fire (G-5). The command receivers have the capability of receiving clock reset commands, but the interim clock as specified in Paragraph 3.8.4.1 cannot be reset. Verification of commands shall be telemetered. Receipt of a ground command shall be indicated by the amber ground command retro reset light located above the telelight sequencing and warning system (see Paragraph 3.8.4.4).

3.14.3 TELEMETRY - Telemetry equipment to be provided shall be a high frequency telemetry transmitter, a low frequency telemetry transmitter and power supplies. Data shall be telemetered to ground stations to provide necessary real time information concerning the capsule, and life support system. Telemetry shall afford backup in the event that onboard data are not retrieved. Reliability shall be obtained through the use of two independent telemetry systems. For the ballistic missions, both telemetry transmitters shall operate continuously.

3.14.3.1 LOW FREQUENCY TELEMETRY TRANSMITTER - The low frequency telemetry transmitter shall operate on 228.20 megacycles with a transmitted output of 3.3 watts. This unit shall transmit scientific and aeromedical information by means of 4 IRIG standard FM subcarriers, one containing PAM modulation (10.5 kc subcarrier) which shall provide 90 data samples, each measured 1-1/4 times per second. This unit shall be capable of 4-1/2 hours continuous operation. R-1 R-1

3.14.3.2 HIGH FREQUENCY TELEMETRY TRANSMITTER - The high frequency telemetry transmitter shall operate continuously on 259.7 megacycles with a transmitted power output of 3.3 watts. This unit shall have the capability of transmitting a power output of 0.6 watts by a simple ground modification required for conversion to the lower power.

3.14.3.3 TELEMETER POWER SUPPLY - Two (2) identical transistorized power supplies shall be provided, one for each transmitter. The power supplies shall operate from the capsule D.C. power supply.

3.14.3.4 TELEMETRY LINE FILTER - A telemetry line filter shall be provided in order to alleviate the possibility of activating the command receivers spuriously. The line filter shall reduce conducted RF energy being fed directly back from the high frequency telemetry transmitter into the capsule wiring to a level compatible with satisfactory system operation.

3.14.4 TRANSPONDERS AND BEACONS

3.14.4.1 C-BAND BEACON - The C-Band radar tracking beacon shall be compatible with the FPS-16 radar system. The C-Band beacon transponder shall consist of a transistorized receiver operating on a 5480.00 megacycle frequency and a transistorized transmitter (except for its magnetron) operating on a 5555.00 megacycle frequency. The transponder input shall be single pulse coded and shall provide sufficient receiver sensitivity to normally attain an 805 statute mile (700 nautical mile) range at orbital altitude. Power output of this unit shall be 375 watts-peak.

3.14.4.2 S-BAND BEACON - The S-Band radar tracking beacon shall be compatible with the SCR-584 Mod. II radar and the VERLORT long range radar. The S-Band beacon transponder shall consist of a receiver operating on a 2900.00 megacycle frequency and a transmitter operating on a 2950.00 megacycle frequency. The transponder input shall be single pulse coded and shall provide sufficient receiver sensitivity to normally attain an 805 statute mile (700 nautical miles) range at orbital altitude. Power output of this unit shall be 1000 watts peak.

3.14.4.3 RECOVERY AIDS

3.14.4.3.1 HF/UHF RESCUE BEACON - The rescue beacon shall facilitate recovery operations. This unit shall be an HF/UHF/MCW pulse modulated unit containing 243 megacycle SARAH rescue beacon and 8.364 megacycle MCW portion of the SEASAVE beacon. The HF beacon shall have a transmitted power output of 1.0 watt and the UHF beacon shall have a transmitted peak power output of 7.5 watts. The HF transmitting portion of the rescue beacon shall be primarily for sky wave propagation and shall have sufficient range for sending a high frequency signal into the

3.14.4.3.1 HF/UHF RESCUE BEACON - (Continued)

ionosphere and returning this signal to scattered global localities for purposes of establishing contact with randomly spaced, ground based direction finding stations typical of those under the direction of the monitoring bureau of the FCC. The UHF transmitting portion of the rescue beacon shall be primarily for establishing contact with airborne search vehicles and shall have a line of sight range of at least 200 nautical miles. The HF/UHF rescue beacon shall receive its power from the 1500 watt/hour isolated battery.

3.14.4.3.2 RESCUE VOICE COMMUNICATIONS - The rescue voice communications system shall consist of an HF transmitter-receiver and a UHF transmitter-receiver. The HF transmitter-receiver shall consist of an amplitude modulated crystal controlled unit which shall operate on a 15.016 megacycle frequency with a 1.0 watt power output and 5 microvolt sensitivity for 10 db signal to noise ratio. The UHF transmitter-receiver shall consist of an amplitude modulated unit which shall operate on a 299.0 megacycle frequency with a 0.5 watt power output at the selected frequency and 3.5 microvolt sensitivity for 10 db signal-to-noise ratio.

3.14.5 COMMUNICATIONS CONTROL PANEL - A communications control panel shall be provided in the lower right-hand corner of the instrument panel. The control panel shall contain audio mixing circuitry, volume controls for the HF, UHF and command receiver voice channels, a "morse code" keying button for high frequency telemetry transmission control, and a direction finding switch. The volume controls shall be vertically mounted.

3.14.6 ANTENNAS - Antennas shall be provided for all communication systems. Antennas for each system shall provide the required coverage for each phase of the mission. Recovery system antennas shall be mounted in such a manner as to prevent loss of signal from water or salt spray. Multiplexers, diplexers, coaxial switches and miscellaneous RF components shall be utilized to interconnect the various units and antennas and to minimize the number of antennas.

3.14.6.1 C AND S-BAND ANTENNA SYSTEM - A C and S-Band antenna system capable of operation during all phases of the mission shall be provided. The C and S-Band Beacons shall be de-energized after impact by a landing system dual inertia switch as indicated on the sequential schematic, Figure 4, Page 43. This antenna system shall be three flush helices for each of the two beacons to provide omnidirectional coverage, and shall include a power divider for each of the two beacons, and matched cabling from the power dividers to the antennas. Each antenna system shall be capable of separate or simultaneous operation. The C and S-Band antennas shall be externally located in a band around the capsule conical section near the junction of the cylindrical recovery compartment.

3.14.6.2 BICONICAL ANTENNA - The biconical antenna shall operate during prelaunch, launch, orbit and re-entry phases of the mission. This antenna shall be incorporated into the antenna housing, and shall be jettisoned at 10,000 feet altitude with the fairing. Through a multiplexing system, the HF and UHF voice communications, both UHF command receivers, and both telemetry transmitters shall utilize the biconical antenna.

3.14.6.2.1 MULTIPLEXER - A multiplexer shall be provided to permit simultaneous or individual operation of HF/UHF transmitter-receivers, high and low frequency telemetry transmitters and both command receivers using the biconical antenna. The multiplexer shall be compatible with the UHF descent antenna for use after ejection of the biconical antenna. This unit shall be located in the capsule pressurized area.

3.14.6.3 UHF DESCENT ANTENNA ARRAY - A descent antenna shall be provided for omnidirectional coverage. This antenna shall be capable of simultaneous operation with both telemetry transmitters, UHF voice transmitter-receiver, UHF rescue beacon and UHF command receivers. The descent antenna shall be located on the capsule parachute housing structure. This antenna shall be tethered until after main (or reserve) chute deployment to prevent possible damage from the chute risers. This antenna shall be spring loaded and shall be extended into the erect operating position after a 16 second time delay from antenna fairing separation by means of a reefing cutter which shall sever tie-down cord upon activation.

3.14.6.4 HF RESCUE ANTENNA SYSTEM - Deleted R-1

3.14.6.5 HF DIPLEXER - An HF diplexer shall be provided for use during the recovery phase to connect the output of the HF portion of the UHF/HF rescue beacon and the HF rescue voice transmitter to the HF rescue antenna. The diplexer shall be located in the capsule pressurized area. R-1

3.14.7 COAXIAL SWITCHES - Two motor-operated coaxial switches shall be provided for switching from the biconical antenna to the UHF descent antenna upon main parachute deployment at 10,000 feet and for switching to the UHF voice transmitter-receiver or the UHF backup voice transmitter-receiver.

3.14.8 COAXIAL CABLES AND CONNECTORS - Raytherm type 12-080S, 12-233, or 12-234 coaxial cable shall be used for all interconnections between the electronic equipment and antennas. Coaxial connectors shall be of the miniature type.

3.15 RECORDING EQUIPMENT - Recording equipment meeting the requirements of Specifications MIL-E-5272A-1 and MIL-E-5400B(ASG) shall be comprised of equipment as specified in the following paragraphs (see Appendix I-C, Item 9 herein). A satisfactory insolation technique shall be employed to avoid crosstalk or interference between systems being fed from common pickups. Methods of data recording within the capsule shall be as noted below and as depicted in Figure 6, Page 58 herein. In addition telemetry equipment for transmitting data from the capsule to ground stations shall be provided as specified in Paragraph 3.14.3.

a. Photographic recording of instrument panel.

b. Photographic recording of earth and sky.

c. Photographic recording of cosmic ray collisions.

3.15.1 CAMERAS - Cameras shall be provided as follows:

a. Instrument Observer Camera - A 16 mm motor operated camera in accordance with MAC Drawing No. 45-88704-3 shall be provided for observation and recording of instrument displays. Film capacity of the instrument observer camera shall be 500 feet (20,000 frames) using cronar base 16 mm film, with a frame rate of 6 frames per second generated by a signal from the data programmer. This camera shall function continuously during the mission as defined in Paragraph 1.1.1. Lens aperture set at f3.5 with shutter speed of 1/30 sec. R-1

b. Earth and Sky Observer Camera - A 70 mm motor operated camera in accordance with MAC Drawing No. 45-88706-1 shall be provided for horizon observation. The earth and sky camera shall be mounted so that it shall utilize the cabin window located in the forward lower right on the capsule. The camera lens shall be aimed at a mirror mounted on the camera to reflect the view of the earth and horizon through the window. Film capacity of the camera shall be 660 frames using 135 feet of MS 33525 cronar base 70 mm film, with a frame rate of 10 frames per minute generated by a signal from the data programmer. This camera shall function continuously during the mission as defined in Paragraph 1.1.1 herein. The camera shall contain an F2.8 lens with filter attached. A timer shall be incorporated within the camera to record the time each exposure is made. A noise filter shall be provided to attenuate noise interference levels within acceptable tolerances. Lens aperture set at f8 with shutter speed of 1/500 sec. R-1

3.15.2 TAPE RECORDER - A tape recorder, MAC No. 45-88707-901 shall be provided for permanent data storage. The recorder shall be programmed to function continuously during all phases of the mission and shall be deactivated by the landing system dual inertia switch upon impact. The tape recorder shall be compatible with the pulse duration modulation system, subcarrier oscillators (VCO) and direct recording mediums. This unit shall have seven heads for recording data at a tape speed of 1-7/8 ips. Tape capacity shall be 3600 feet of 1/2 inch mylar base tape. A limit switch shall be provided for interrupting power to the recorder in event of tape breakage. Recording tracks shall be as follows: R-1

Track No. 2 - Direct recording - VCO mixer output R-1

Track No. 3 - Direct recording of UHF voice below 3125 cps

Track No. 5 - Pulse recording - composite PDM signal from Commutator/Keyer unit "B" (see Figure 6)

Track No. 6 - Pulse recording - composite PDM signal from Commutator/Keyer unit "A" (see Figure 6) R-1

3.15.2.1 COMMUTATED DATA RECORDING - Two PDM/PAM commutator/keyer systems, MAC No. 45-88709-3, shall be provided. These units shall commutate transducer data and shall supply PDM and PAM outputs. The commutator portion of each unit shall signal inputs at a rate of 112-1/2 samples per second providing 90 data samples, each measured 1-1/4 times per second, producing a signal wave train. The PAM wave train output shall be transmitted to the PAM/PDM converter. The PDM output shall be supplied to a record amplifier which shall produce a signal capable of directly driving a recorder head in the tape recorder. The PAM output shall be transmitted to ground station automatic decommutation equipment. Each unit shall have its own power to provide required voltages.

3.15.2.2 PLAYBACK TAPE RECORDER - Two playback recorders, Mohawk "Midgetape" Model 400, shall be provided in accordance with MAC Drawing No. 45-88104-1. These recorders shall have prepared messages recorded at timed intervals. The messages shall be programmed for intermittent operation such that as one unit becomes operative, the other shall be silent. R-1

3.15.3 COSMIC RAY FILM PACK - Four photographic recorders of cosmic ray collisions shall be installed in the capsule. These shall be furnished by NASA and shall be installed at the launch site (see Appendix I-A).

3.15.4 DATA PROGRAMMER - A data programmer, MAC No. 45-88710-5 shall be provided to program continuous operation of the instrument observer camera and the earth and sky camera at their respective frame rates. The MAC No. 45-88710-5 programmer shall contain circuitry provisions for programming an astronaut observer camera, which shall not be provided in Capsule No. 2.

3.15.5 SOUND AND VIBRATION MEASURING SYSTEMS - A sound level measuring system, MAC No. 45-88713-1, shall be provided. This system shall consist of a piezoelectric/diaphragm type microphone which shall pick up pressure levels from 110 to 140 decibels in a frequency range of 37 to 9600 cps. It is anticipated that the sound pressure level during the launch phase may be approximately 135 decibels. Vibration measurements shall be recorded by the vibration measuring system, MAC No. 45-88714-3. This system shall consist of a piezoelectric transducer for vibration pickup in a frequency range of 10 to 2000 cps, and a vibration amplifier for increasing the output of the transducer to a level compatible with the vibration and acoustical analyzer, MAC No. 45-88711-1. This analyzer shall accept and convert acoustical and vibration data to amplitude vs frequency signals for recording as indicated in Figure 6.

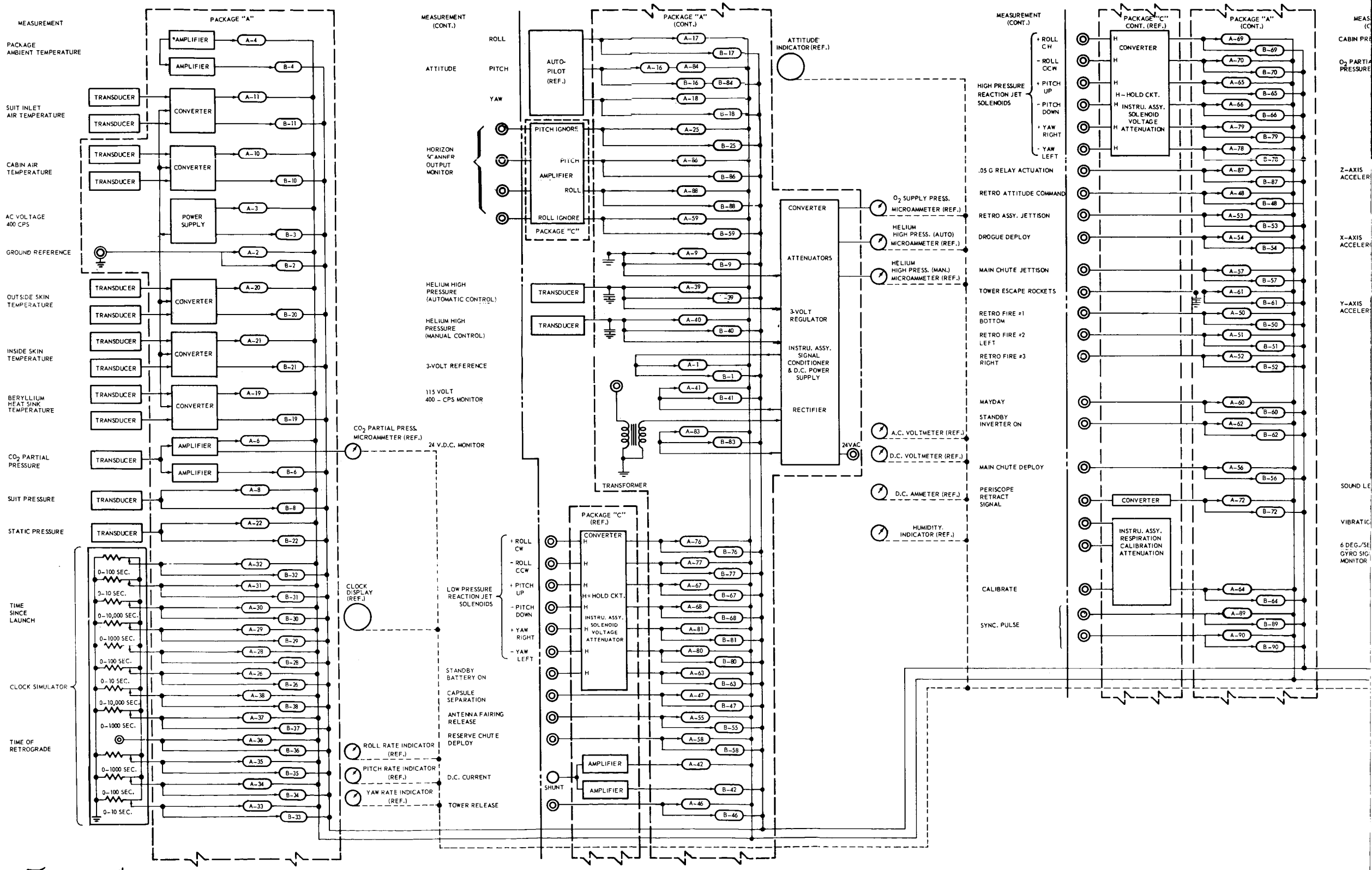
3.15.6 VOLTAGE CONTROLLED SUBCARRIER OSCILLATORS - Voltage controlled oscillators as indicated in Figure 6 and Appendix I-C, Item 9, shall be provided. PAM outputs from the commutators, and pitch, roll and yaw signals from the rate package shall apply instrumentation data voltages to the subcarrier oscillators. R-1

3.15.6.1 COMPENSATING OSCILLATORS - A compensating fixed frequency oscillator shall be provided for monitoring tape recorder wow and flutter. This shall be adjusted to operate at 3125 cps with an adjustable voltage output.

3.15.6.2 MIXER AMPLIFIER - One mixer amplifier shall be provided for each commutator/keyer. Through the Zener Diode power supply 24 volts D.C. from the capsule power source shall be converted to 6 volts D.C. for use by the subcarrier oscillators. One mixer MAC No. 45-88700-55 shall mix and amplify oscillator outputs to telemetry transmitter "B" only. The other mixer MAC No. 45-88217-1B, shall mix and amplify oscillator outputs to telemetry transmitter "A" and in addition by means of a filter reduce the 10.5 kcps mixer output to a level more compatible with the inputs of the tape recorder. A subcarrier output signal of 3.125 kcps shall be eliminated from telemetry transmitter "A" input terminal by bypassing the transmitter output in the MAC No. 45-88217-1B. R-1

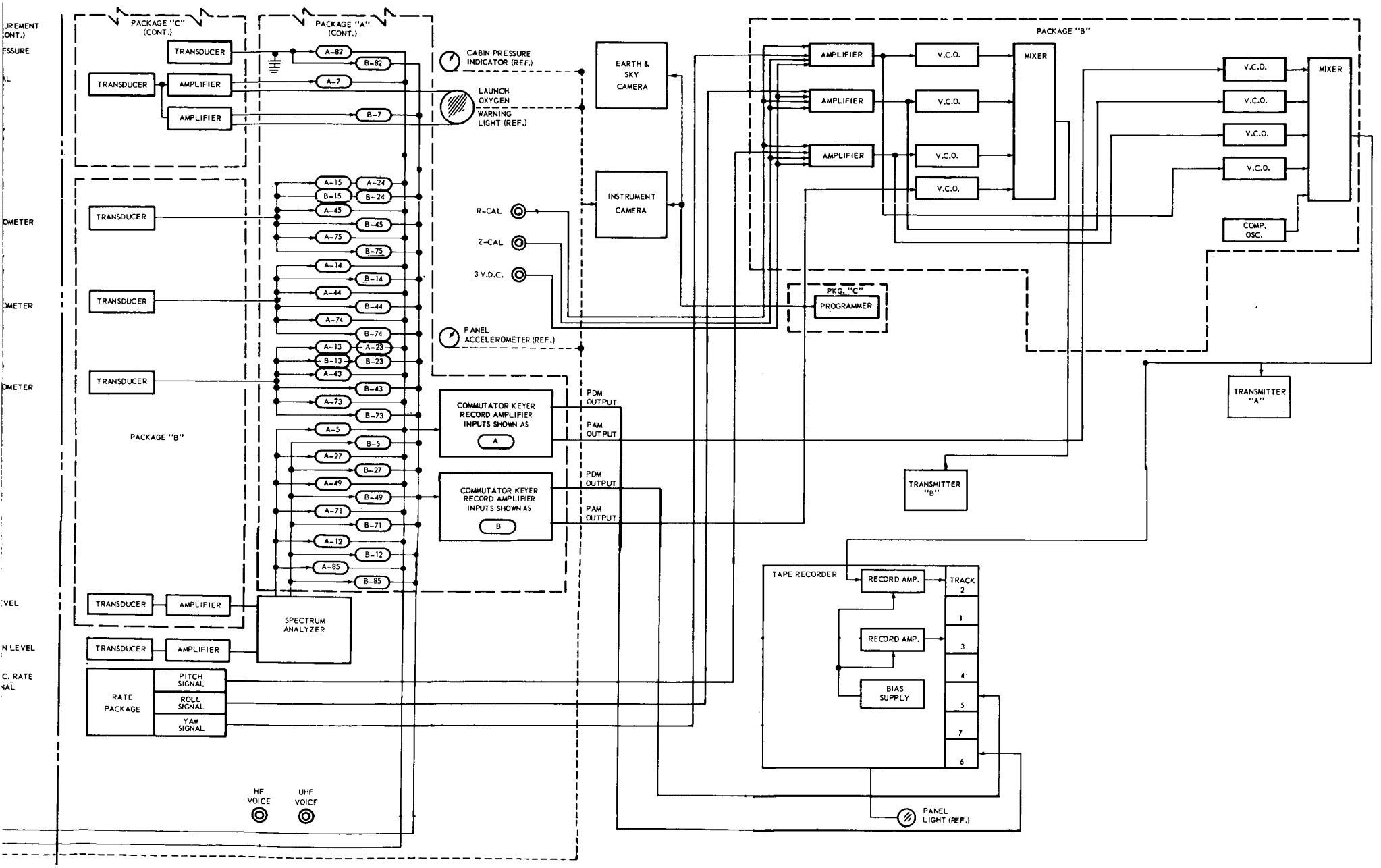
BASIC INSTRUMENT SYSTEM BLOCK DIAGRAM

NOTE: THIS BLOCK DIAGRAM INCLUDES EQUIPMENT SUPPLIED WITH CAPSULE 2 ONLY



FOLD-OUT #1

FIGURE 6


PACKAGE "C" (CONT.)
PACKAGE "A" (CONT.)
PACKAGE "B"
TRANSDUCER
AMPLIFIER
A-82
B-82
A-7
B-7
CABIN PRESSURE INDICATOR (REF.)
LAUNCH OXYGEN WARNING LIGHT (REF.)
EARTH & SKY CAMERA
INSTRUMENT CAMERA
R-CAL
Z-CAL
3 V.D.C.
PANEL ACCELEROMETER (REF.)
A-15
B-15
A-24
B-24
A-45
B-45
A-75
B-75
A-14
B-14
A-44
B-44
A-74
B-74
A-13
B-13
A-23
B-23
A-43
B-43
A-73
B-73
A-5
B-5
A-27
B-27
A-49
B-49
A-71
B-71
A-12
B-12
A-85
B-85
COMMUTATOR KEYER RECORD AMPLIFIER INPUTS SHOWN AS A
COMMUTATOR KEYER RECORD AMPLIFIER INPUTS SHOWN AS B
PDM OUTPUT
PAM OUTPUT
PDM OUTPUT
PAM OUTPUT
SPECTRUM ANALYZER
RATE PACKAGE
PITCH SIGNAL
ROLL SIGNAL
YAW SIGNAL
HF VOICE
UHF VOICE
PACKAGE "B"
AMPLIFIER
V.C.O.
MIXER
COMP. OSC.
PKG. "C"
PROGRAMMER
TRANSMITTER "A"
TRANSMITTER "B"
TAPE RECORDER
RECORD AMP.
BIAS SUPPLY
TRACK
2
1
3
4
5
7
6
PANEL LIGHT (REF.)

FOLD-OUT #2

3.16 NAVIGATIONAL AIDS - Navigational aids such as a chartboard, maps, hand computer and tables, normally provided for astronaut manual navigational procedures shall not be provided in Capsule No. 2, with the exception of the periscope as described below.

3.16.1 PERISCOPE - An optical periscope, MAC No. 45-86701-7, shall be provided. (See Appendix I-C, Item 3.18 herein.) This unit shall be located to partially support the instrument panel (see Paragraph 3.8.3) such that its display appears in the lower center of the instrument panel. This installation shall provide an optical reference point at FZ 135.59, TY 5.780 and X0.00 station lines, based upon an astronaut's eye reference point at FZ 118.20, TY 22.82 and RX 1.28. In this capsule periscope installation, the eye distance shall be approximately 0.75 inch shorter than that of manned capsule installation. The periscope shall provide an 8 inch diameter circular display with the image plane inclination at approximately 45 degrees from the Y0.00 axis. The periscope circular display shall provide the following:

a. Outer view of the horizon circle.

b. Center downward view of the spherical earth. R-1

c. High and low magnification of the center view of the point where the vertical intersects the earth's surface. The low magnification shall provide a 175 degree minimum field angle. R-1 The high magnification shall provide a center field of view of 19 degrees maximum with magnification increased accordingly. R-1 Magnification view shall be preset prior to flight.

d. Target index located in the center for definition of earth position relative to intersection of vertical with the earth's surface.

e. Adjustable altitude indices and visual altitude indication.

f. Attitude indices for indication of pitch and roll attitudes.

g. -43 degree retrograde pitch attitude fixed indices.

h. Fixed reticle lines shall be provided for earth and sky camera field of view when capsule is aligned to vertical.

i. Fixed reticle lines for alignment of the capsule normal axis with the earth vertical.

j. A -14° 30' true vertical index on upper portion of display.

3.16.1 PERISCOPE - (Continued)

k. Drift indices and drift set scale for capsule orientation with the ground track.

l. Sun-moon index - A graduated settable 360 degree index about the perimeter for measurement of the angle of the rising or setting sun or moon relative to the capsule longitudinal axis. The sun-moon index control tab shall not be provided with this installation. A high density sun filter shall be provided for viewing of the sun without eye discomfort or damage in manned flights.

m. Clear, yellow and two neutral density optical filters. These shall be manually selected in manned capsules which shall have clear, yellow neutral density and red filters.

The lower optical portion of the periscope and the periscope access door shall extend or retract automatically. Automatic extension and retraction shall occur in less than 5 seconds each. An amber light located on the upper left of the periscope display shall illuminate at any time when the lower optical portion of the periscope is in any position between locked extended and locked retracted in the retract cycle.

Power requirements of the MAC No. 45-86701-7 periscope assembly may be as high as 110 watts maximum in lieu 60 watts as required in orbital missions.

3.16.1.1 PERISCOPE CONTROLS - The following controls shall be provided on the periscope:

a. Reticle illumination control knob)
b. Altitude knob and indicator) On periscope face
c. Drift knob)

d. Sun-moon index control lever - not provided with this unit.

e. Two-position (high and low) magnification change knob not provided on this periscope installation-magnification preset prior to launch.) On Left-Hand Side of Body

f. Filter selector knob - this knob shall rotate 50° in lieu of 30° in manned capsules.) On Left-Hand Side of Body

g. Extension and retraction control lever (45° travel) - On right-hand side of body, but not provided on this periscope installation.

3.17 LANDING AND POST LANDING SYSTEMS - A capsule landing system in accordance with MAC Drawing No. 45-41700 shall be provided, consisting of components tabulated in Appendix I-C herein, Item 10. The landing system shall include two independent parachute systems, sequencing control system, and post landing equipment. All parachutes, harnesses and parachute bags as specified herein shall be shipped directly to the launch site where they will be Government inspected and packed.

3.17.1 LANDING SYSTEM - The landing system shall consist of a primary system comprising a main parachute, a drogue parachute, and associated sequencing controls; and a reserve system comprising a reserve parachute, a pilot parachute, and associated sequencing controls. The landing system sequencing controls shall be armed by the tower separation sensor. For aborted missions, a programmed time delay of a minimum of three (3) seconds shall provide a sufficient time lapse required for various functional sequences during the abort maneuver.

3.17.1.1 DROGUE PARACHUTE SYSTEM - A six (6) foot diameter conical ribbon type drogue parachute assembly with a thirty (30) foot bridle length, shall be provided for an adequate dynamic stability and deceleration during the re-entry phase. The drogue chute shall be constructed of cotton, nylon and dacron materials and shall be designed for a dynamic pressure of 116 pounds per square foot considering deployment at a geometric pressure of 40,000 feet. The drogue chute shall be stowed in a drogue chute bag. This assembly, a chaff packet, compatible with C and S band radar, and a mortar sabot shall be located in the drogue mortar tube. At 21,000 feet barometric pressure altitude, a barostat (aneroid pressure switch) shall receive static pressure from a static plenum chamber and convert it to an electrical signal which shall be transmitted to a cartridge squib located under the mortar tube, initiating a gas charge. The gas charge shall force the mortar sabot, and drogue chute assembly from the mortar tube causing the chute to deploy. The drogue chute shall be attached to the antenna fairing by a 3-riser arrangement and shall be released by ejection of the antenna fairing. R-1 R-1

3.17.1.2 MAIN PARACHUTE SYSTEM - The main parachute assembly shall be a sixty-three (63) foot diameter reefed (12 percent for 4 seconds) ring-sail type parachute designed to provide a stabilized sinking speed of thirty (30) feet per second at five thousand (5000) feet altitude for a two thousand one hundred sixty (2160) pound capsule. The main parachute of nylon material shall be designed and constructed to withstand shock loads encountered at ten thousand (10,000) feet deployment altitude at velocities up to 164 knots equivalent air speed. It shall be considered that there has been no velocity decrement occasioned by drogue chute deployment, so that drogue chute failure cases shall be completely covered.

3.17.1.2 MAIN PARACHUTE SYSTEM - (Continued)

The main parachute shall be stowed in the cylindrical recovery compartment aft of the conical afterbody and its riser shall be connected to the antenna fairing so that upon its ejection, the main chute shall be deployed. A parachute deployment bridle, fabricated from 750 pound tubular nylon webbing, R-1
shall be attached to the apex of the parachute in such a manner that the loads encountered upon parachute deployment shall be distributed symmetrically about the apex. This shall take place at ten thousand (10,000) feet geometric R-1
pressure altitude as sensed by a barostat (aneroid pressure switch). The barostat shall transmit an electrical firing signal to the antenna fairing ejector assembly subsequently ejecting the antenna fairing. The barostat shall also initiate opening of the reaction control system pitch and yaw high thrust chambers; extension of the periscope for two hundred (200) seconds; and, arming of the impact sensor (dual inertia switch) after a tweleve (12) second time delay. Upon separation of the antenna fairing, the main chute ejector gas generator assembly shall be electrically initiated, and shall produce gas for injection into the main parachute ejector bag, which, with the antenna fairing, shall eject the main chute pack from the recovery compartment. As this occurs, the main chute shall pull out of the main chute deployment bag, releasing the antenna fairing, drogue chute and bag. At the time of main chute ejection, a SOFAR bomb, preset for sound ranging at a depth of twenty-five hundred (2500) feet, shall be ejected. (See Paragraph 3.17.2.1.) Separation of the antenna fairing shall energize the cabin air inlet and exhaust valve "open" circuit for ventilation in low altitude abort maneuvers; energize the 243 mc SARAH rescue beacon; de-energize the ASCS; switch from the bicone antenna to the UHF descent antenna; and, simultaneously energize a 60 second time delay relay and power and control relay which shall open the reacton control system pitch and yaw high level thrust chambers to expire H_2O_2 until runout of the time delay relay. Gore colors of the main parachute shall be natural and international orange alternately arranged.

3.17.1.3 PILOT PARACHUTE - The pilot parachute shall be a flat circular type, seventy-two (72) inch diameter parachute with R-1
a 30 foot bridle length. Construction shall be of nylon cloth, with nylon webbing and cord, designed for deployment in event of failure of the drogue and main parachutes. This system shall be inoperative in Capsule No. 2 by detection of the riser load sensor.

3.17.1.4 RESERVE PARACHUTE - The reserve parachute assembly shall be a sixty-three (63) foot diameter reefed ring-sail type parachute identical in design, construction and reefing to the main parachute. The reserve parachute shall be stowed in the cylindrical recovery compartment. In a normal landing sequence where the reserve chute has not been deployed, the reserve chute shall be ejected from the capsule through the "rescue aids" toggle switch (P-15) which shall be set in the "Post Landing" (closed) position prior to launch. This action shall take place after a twelve (12) second time delay (armed upon sensing antenna separation) has closed energizing a dual inertia switch which shall energize the closed "Rescue Aids" circuitry. R-1

3.17.2 POST LANDING SYSTEM - The post landing system shall include one SOFAR bomb, dye marker package, and inertia switches for actuation of equipment essential to recovery.

3.17.2.1 SOFAR BOMB - Two SOFAR bombs shall be installed. One SOFAR bomb, armed for sound ranging at 2500 feet depth, shall be ejected at main parachute deployment. The second bomb located in the cabin area shall be armed for sound ranging at 3000 feet.

3.17.2.2 DYE MARKER - A dye marker packet assembly shall be provided to aid in visual location during the search phase. In a normal landing sequence, the dye marker shall be ejected after reserve chute ejection and impact on the water. The dye marker shall be yellow-green in color and shall be packaged in a water soluble container attached to the capsule by a retainer line. R-1

3.17.2.3 SMOKE GENERATOR - No smoke generators shall be provided in the recovery system. However, installation provisions for five generators remain in this capsule.

3.17.2.4 RECOVERY FLASHING LIGHT - A high intensity flashing recovery light in accordance with MAC Drawing No. 45-86702-3 shall be provided. Flashing rate of the light shall be at least fifteen (15) flashes per minute at an intensity which shall be visible below twelve thousand (12,000) feet at a distance of approximately fifty (50) nautical miles on a starlit moonless night at a relative humidity of at least ninety (90) percent. The light shall have self-contained batteries.

3.17.2.5 IMPACT SENSOR - The impact sensor (dual inertia switch) shall initiate the following functions:

a. Initiate main parachute disconnect.

b. Initiate the reserve parachute ejector and disconnect and the pilot parachute deployment gun. The rescue aids switch (P-15) shall be set in the closed position prior to launch for actuation of these.

c. Deleted R-1

d. Energize SEASAVE beacon.

e. Energize HF rescue transceiver.

f. Energize UHF unit for continuous transmission for direction finding.

g. Start recovery flashing light.

h. De-energize excess communications and instrumentation.

i. Arm a 5 second time delay which shall be energized by the closed rescue aids switch circuit. R-1

3.18 HANDLING PROVISIONS - A hoisting loop assembly, MAC No. 45-32188-901, shall be provided for capsule pick-up by helicopter. The loop shall be attached to the recovery compartment structural assembly by two hoist loop support fittings. The hoist loop shall be constructed of 9,000 pound capacity dacron webbing with a fiberglas plastic spring strap sewn in the dacron to cause the loop to erect upon ejection of the antenna fairing. Two auxiliary hoisting fittings, MAC No. 45-32068-1, located at capsule station line Z123.00, shall be provided.

3.19 SUPPORT EQUIPMENT - Support equipment for Mercury capsule shall be as separately negotiated in CCP Series 52.

3.20 PYROTECHNICS - Pyrotechnic devices in accordance with MAC Drawing No. 45-72001 (-2 Assembly as specified in Appendix I-C, Item 11 herein) shall be provided for the following:

a. Umbilical disconnect

b. Capsule-adapter clamp ring separation

c. Tower clamp ring separation

d. Retro package release

e. Parachute deployment and disconnect

f. Antenna fairing ejection

g. Sound ranging and fixing (SOFAR)

h. Rescue antenna extension

i. Snorkel valve actuation

Pyrotechnics with the exception of snorkel valve squibs shall be installed at the launch site.

4.0 QUALIFICATION

4.1 MAC QUALIFICATION - Qualification of equipment and subsystems shall be accomplished by MAC or by subcontractors under MAC direction as defined in MAC Report 6495 and in component specification control drawings. Qualification status of parts shall be as tabulated in MAC Drawing No. 45-00003, as of 22 June 1960.

4.2 NASA QUALIFICATION - The capsules supplied by the contractor will be used in a qualification flight test program to be conducted by the NASA. The capsule and its systems shall demonstrate satisfactory performance within the framework of this specification. This qualification program will have as its final objective the accomplishment of the missions described in Paragraph 1.1.1 herein and launching of a manned capsule into a semi-permanent orbit and subsequent safe recovery to the surface of the earth at a designated time and/or position through the use of retrograde thrust and aerodynamic drag.

5.0 TESTING

5.1 MAC TESTING - The contractor shall undertake structural, aerodynamic, hydrodynamic, equipment, compatibility, acceptance, and evaluation tests as required in support of the capsule development program.

5.2 NASA TESTING - A program of research and development flight testing of the capsule will be undertaken by the NASA. This program will include full-scale flight tests of simplified capsules of which Capsule No. 2 described herein shall be utilized in Mercury-Redstone Test Shot No. 1.

6.0 DEFINITIONS -

NASA National Aeronautics and Space Administration

MAC McDonnell Aircraft Corporation

Normal land impact - Landing in the vicinity of the launching pad at Cape Canaveral. This local terrain shall be studies so that the soil characteristics used in landing calculations will represent conservative values for a large percentage of the possibilities. Wind drift and parachute swing angles used will be based on probability studies.

APPENDIX I-A

GOVERNMENT FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

IDENTIFICATION

Item	Qty.	Nomenclature
1	4 *	Film Pack, Cosmic Ray
2	1 *	SOFAR Bomb, 2500 ft. depth
3	1 *	SOFAR Bomb, 3000 ft. depth
4	1 *	Chaff Package

R-1

APPENDIX I-B

GOVERNMENT FURNISHED EQUIPMENT - GOVERNMENT INSTALLED

Not Used

*To Be Installed At Launch Site.

APPENDIX I-C

CONTRACTOR FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.	
1	1	General Assembly, Mercury Including:	45-00001-7	-	
1.1	1	Structural Assembly, Pylon	45-31001-305	-	R-1
1.2	1	Antenna Assembly, Communi-cations	45-31003-3	-	
1.3	1	Capsule Assembly	45-32000-3	-	
1.3.1	1	Structural Assembly, Capsule	45-32001-301	-	
1.3.1.1	1	Structural Assembly, Conical Section	45-32002-301	-	
1.3.1.1.1	2	Window Assembly, Capsule Inner	45-35010-1	-	
1.3.1.2	1	Structural Assembly, Cylindrical Section	45-32003-1	-	
1.3.2	1	Shingle Installation, Capsule	45-32245-307	-	
1.3.3	1	Insulation Installation	45-32038-1	-	
1.3.4	1	Heat Sink, Beryllium (B_E) Including:	45-32051-3 (MRR: 14747)	-	
1.3.4.1	6	Shim	45-32051-9	-	
1.3.4.2	2	Heli-Coil Insert	-	Heli Coil Corp. 3951-3TN-.190	
1.3.4.3	48	Heli-Coil Insert	-	Heli-Coil Corp. 3591-4CN-375	

APPENDIX I-C

CONTRACTOR FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	Mfg. No.
1.3.5	48	Bushings	45-32053-3	-
1.3.6	1	Door Assembly, Periscope	45-32091-1	-
1.3.7	1	Pin, Periscope Door Hinge	45-32093-3	-
1.3.8	2	Window Assembly, Capsule Outer	45-35025-1	-
1.4	1	Adapter Assembly, Redstone	45-33600-1	-
1.5	1	System Installation, Recovery (See Item 10)	45-41001-302	-
1.6	1	Rocket Installation, Retrograde (See Item 2)	45-50001-1	-
1.6.1	6	Spacer, Adjusting Retro	45-50014-5	-
1.6.2	3	Retention Assembly, Retrograde Package	45-72030-301	-
1.7	1	Rocket Installation, Escape (See Item 2)	45-51001-301	-
1.7.1	1	Escape Rocket Assembly	45-51002-303	-
1.7.1.1	1	Ballast, Nose	45-51010-301	-
1.7.1.2	2	Fairing, Rocket Junction Box Lug	45-51022-3	-
1.7.1.3	2	Fairing, Escape Rocket, Tunnel Wiring	45-51023-1	-
1.7.1.4	1	Spike Assembly, Aerodynamic Ballasted	45-51017-1	- R-1

APPENDIX I-C

CONTRACTOR FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
1.8	1	System Installation, Manual Controls	45-61001-3	-
1.8.1	1	H_2O_2 System Installation	45-61075-3	-

APPENDIX I-C

CONTRACTOR FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
1.9	1	System Installation, Reaction Controls (See Item 5)	45-62001-17	-----
1.9.1	1	Installation, Antenna Kite	45-62003-1	-----
1.9.2	1	Pressurization Installation, Reaction Controls, Manual and Automatic	45-62010-3	-----
1.9.3	1	Pressurization Installation, Reaction Controls, Manual and Automatic	45-62010-5	-----
1.9.4	1	Fuel Installation, Reaction Control	45-62040-7	-----
1.9.5	1	Installation, Min. "K" Insulation, Reaction Controls	45-62049-1	-----
1.10	1	System Installation, Pyrotechnics (See Item 11)	45-72001-2	-----
1.10.1	1	Wedge Installation, Stability	45-0434-301	-----
1.10.2	1	Clamp Ring, Capsule-Adapter	45-72010-3	-----
1.10.3	1	Installation, Antenna Fairing Ejector	45-72020-303	-----
1.10.4	1	Installation, Retaining Ring, Pylon to Capsule	45-72040-1	-----
1.10.5	1	Installation, Emergency Controls (Manual)	45-72050-1	-----
1.11	1	Electrical Installation, Escape Rocket	45-77000-1	-----

APPENDIX I-C

CONTRACTOR FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
1.12	1	Electrical Installation, Pylon	45-77001-1	-	
1.13	1	Electrical Installation, Antenna Fairing	45-77002-1	-	
1.14	1	Electrical Installation, Midsection	45-78000-1	-	
1.15	1	Electrical Installation, Heat Sink	45-78001-1	-	
1.16	1	Electrical Installation, Retrorocket	45-78002-305	-	
1.17	1	Electrical Installation, Adapter Redstone	45-79200-1	-	
1.18	1	Equipment Installation Cabin 2 (See Items 3, 4, 5, 6, 7, 8 and 9)	45-80003	-	
1.18.1	1	Equipment Installation, R.H. Console	45-81002-1	-	
1.18.2	1	Main Instrument Panel	45-81000-909	-	
1.18.3	1	Panel Assembly, L.H. Console	45-81010-309	-	
1.18.4	1	Mirror Assembly, Earth and Sky Camera	45-86014-1	-	
1.18.5	1	Cover Plate, Instrument Mounting	45-81017-1	-	R-1

APPENDIX I-C

CONTRACTOR FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

GENERAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
1.19	1	Instrumentation Installation, Special (See Item 9)	45-88510-1	------
1.19.1	1	Pallet Assembly	45-88501-3	------
1.19.2	1	Crushable Support Assembly	45-82001-35-2	------
1.19.3	1	Crushable Support Assembly	45-82001-39-2	------
1.19.4	1	Crushable Support Assembly	45-82001-43-2	------
1.19.5	1	Crushable Support Assembly	45-82001-47-2	------
1.19.6	1	Crushable Support Assembly	45-82001-51-2	------

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ROCKET INSTALLATIONS

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
2		Capsule Rocket Installations		
2.1	3	Rocket Assembly, Retrograde, consisting of:	45-50700-13	-----
2.1.1	1	Rocket, Retrograde	45-50700-3	Thiokol: TE-316
2.1.1.1	1	Pressure Switch		
2.1.2	1	Heater Assembly	45-50702-11	COX: 6005-11
2.1.3	1	Heater	45-50702-7	COX: 6005-7
2.1.4	1	Temperature Control Unit	45-50702-13	-----
2.2	3	Rocket, Posigrade	45-50701-3	Atlantic-Research: D20763
2.3	1	Rocket, Escape System	45-51700-3	Grand-Central: 477-80100
2.4	1	Rocket, Pylon Jettison	45-51701-15	Atlantic-Research: E-22851

R-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AIRBORNE EQUIPMENT

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
3		Airborne Equipment, Consisting of:		
3.1	1	Longitudinal Accelerometer (See Paragraph 3.8.4.3)	45-81702-9	Burton: 2062X
3.2	1	Altimeter	45-81704-5	Kollsman Instruments: A 33841-10-001
3.3	1	Clock (See Paragraph 3.8.4.1)	45-81059-1	-----
3.4	1	D.C. Voltmeter	45-81716-3	Weston Instrument: 183537
3.5	1	D.C. Ammeter	45-81717-3	Weston Instrument: 183538
3.6	1	A.C. Voltmeter	45-81718-3	Weston Instrument: 183539
3.7	1	Indicator, Auto-Man Fuel	45-81719-7	Weston Instrument: 183540
3.8	1	Transducer (Pitch)	45-81721-5	Minneapolis-Honeywell GG 134A-1 (MRR-129JA22)
3.9	1	Transducer (Roll)	45-81721-7	Minneapolis-Honeywell GG 134A-2 (MRR-129JA22)

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AIRBORNE EQUIPMENT (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
3.10	1	Transducer (YAW)	45-81721-9	Minneapolis-Honeywell GG 134A-3 (MRR-129JA22)	
3.11	1	Indicator, Angular Rate and Attitude (See Paragraph 3.8.4.2)	45-81721-11	Minneapolis-Honeywell JF 282A-1	
3.12	1	Earth Path Indicator (See Paragraph 3.8.4.5)	45-81722-3	Minneapolis-Honeywell DJG 280A-1 Series A5	
3.13		Deleted			R-1
3.14	1	Indicator, (Dual) O_2 Quantity	45-83706-5	Weston Instrument: 183541	
3.15	1	Indicator, Cabin Pressure	45-83707-3	Kollsman Instrument: A 33681-10-001	
3.16	1	Indicator, Cabin Air Temperature	45-83708-3	Weston Instrument: 183513	
3.17	1	Indicator, Humidity	45-83712-3	Minneapolis-Honeywell JG 284A-1 Series 4	R-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AIRBORNE EQUIPMENT (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
3.18	1	Periscope (See Paragraph 3.16.1)	45-86701-7	Perkin-Elmer 539-0103 (MRR 129KA309) (MRR 10JA3)
3.19	2	Horizon Scanner (See Paragraph 3.10.2)	45-87702-3	Barnes Engineering: 13-130
3.20	1	Indicator, Coolant Quantity	45-83701-3	Weston Instrument: 183543

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.	
4		Electrical Equipment, consisting of:			
4.1	1	Diode Panel Assembly, Power System Control	45-78012-301	-----	
4.2	1	Relay Panel Assembly, Instrumentation Control	45-78016-1	-----	
4.3	1	Relay Panel Assembly, Power System Control	45-78081-323	-----	
4.4	1	Relay Panel Assembly, Launch, Orbit and Escape Sequential	45-78084-27	------	
4.5	1	Relay Panel Assembly, Launch, Orbit and Escape Sequential	45-78084-301	-----	
4.6	1	Relay Panel Assembly, Launch, Orbit and Escape Sequential	45-78084-319	-----	
4.7		Deleted			R-1
4.8	1	Relay Panel Assembly, Retrograde Sequential	45-78085-325	-----	
4.9	1	Relay Panel Assembly, Retrograde Sequential	45-78085-335	-----	
4.10	1	Relay Panel Assembly, Recovery Sequential	45-78086-3	-----	
4.11	1	Relay Panel Assembly, Recovery Sequential	45-78086-73	-----	
4.12	1	Relay Panel Assembly, Recovery Sequential	45-78086-305	-----	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
4.13	1	Relay Panel Assembly, Recovery Sequential	45-78086-331	-	
4.14	1	Relay Panel Assembly, ASCS System	45-78090-301	-	
4.15	1	Relay Panel Assembly, Instrumentation and Control	45-78092-303	-	R-1
4.16	1	Relay Panel Assembly, Special Instrumentation	45-78097-301	-	
4.17	3	Thermostat Assembly, Retrograde Rockets, each consisting of:	45-79705-11	United Controls: 1310-1	
4.17.1	1	Sensor	45-79705-7	-	
4.17.2	1	Clamp Ring	45-79705-9	-	
4.18	3	Battery (3000 Watt-Hour)	45-79707-17	Eagle Pitcher: MAR-4027-C	
4.19	3	Battery (1500 Watt-Hour)	45-79707-19	Eagle Pitcher: MAR-4028-B	
4.20	2	Static Inverter (250 VA)	45-79709-1	Interelectronics: 28T15A40HA-2 MRR:20KA91 and MRR:20KA98	
4.20.1	2	Heat Sink, Inverter	45-87025-55	-	R-1
4.21	1	Static Inverter (150 VA)	45-79709-3	Interelectronics 28T15A40GB2	R-1
4.21.1	1	Heat Sink, Inverter	45-87025-57	-	R-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
4.22	2	Filter Assembly	45-79709-7	Interelectronics 28FA30GHA-2	
4.23	35	Power and Control Relay	45-79712-2	Filtors: P26A1H6A9	R-1
4.24	14	Power and Control Relay	45-79712-8	Potter-Brumfield SL4080-1	R-1
4.25	8	Power and Control Relay	45-79712-12	Leach: 9227-5369	R-1
4.26	2	Power and Control Relay	45-79712-15	Leach: 9226-5368	
4.27	3	Power and Control Relay	45-79712-16	Leach: 9224-5367	
4.28	9	Power and Control Relay	45-79712-33	Filtors: 26SR18F	
4.29	10	Power and Control Relay	45-79712-34	Filtors: LL26E18	
4.30	6	Power and Control Relay	45-79712-19	Leach: 9229-5371	
4.31	9	Power and Control Relay	45-79712-21	Leach: 9220-5366	
4.32	4	Power and Control Relay	45-79712-22	Leach: 9228-5370	
4.33	4	Power and Control Relay	45-79712-23	Leach: 9223-5375	
4.34	1	Power and Control Relay	45-79712-24	Leach: 9237-5376	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
4.35	4	Power and Control Relay	45-79712-26	Leach: 9274-5300	
4.36	5	Power and Control Relay	45-79712-27	Leach: 9274-5377	
4.37	2	Power and Control Relay	45-79712-28	Leach: 9229-5372	
4.38	2	Power and Control Relay	45-79712-32	Leach: 9220-5378	
4.39	3	Limit Switch	45-79713-3	Electro-Snap: H11-52	
4.40	2	Limit Switch	45-79713-7	Electro-Snap: H11-51	
4.41	3	Limit Switch	45-79713-9	Electro-Snap: H11-50	
4.42		Deleted			R-1
4.43	3	Limit Switch	45-79713-57	Electro-Snap: H11-119	R-1
4.44	3	Limit Switch	45-79713-59	Electro-Snap: H11-120	R-1
4.45	7	Limit Switch	45-79713-23	Haydon Switch 61375	
4.46	7	Limit Switch	45-79713-25	Electro-Snap: 42-041	
4.47	4	Limit Switch	45-79713-33	Haydon-Switch: 61401	
4.48	5	Relay - Time Delay 2 Seconds	45-79715-1	Wheaton: E371-A	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.	
4.49	5	Relay - Time Delay 5 Seconds	45-79715-7	Wheaton: E371-D	
4.50	4	Relay - Time Delay 10 Seconds	45-79715-11	Wheaton: E371-E	
4.51	2	Relay - Time Delay 15 Seconds	45-79715-13	Wheaton: E371-F	
4.52	1	Relay - Time Delay 20 Seconds	45-79715-15	Wheaton: E371-G	
4.53	2	Relay - Time Delay 30 Seconds	45-79715-17	Wheaton: E371-H	
4.54	1	Relay - Time Delay 35 Seconds	45-79715-23	Wheaton: E371-K	
4.55	1	Relay - Time Delay 300 Seconds	45-79715-67	Wheaton: E376A	R-1
4.56	1	Relay - Time Delay 30 Seconds	45-79715-33	Wheaton: E372-A	
4.57	1	Relay - Time Delay 30 Seconds	45-79715-37	Wheaton: E372-E	
4.58	2	Relay - Time Delay 60 Seconds	45-79715-39	Wheaton: E372-F	
4.59	1	Relay - Time Delay 200 Seconds	45-79715-41	Wheaton: E375-C	
4.60		Deleted			R-1
4.61	1	Relay - Time Delay 600 Seconds	45-79715-45	Wheaton: E409	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
4.62		Deleted			R-1
4.63		Deleted			R-1
4.63.1		Deleted			R-1
4.63.2		Deleted			R-1
4.63.3		Deleted			R-1
4.63.4		Deleted			R-1
4.64	1	Telelight Assembly Consisting of:	45-79720-53	Grimes: 33340-53-327	
4.64.1	1	Clip	45-79720-45	Grimes: 33340-45	
4.64.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327	
4.64.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327	
4.64.4	1	Nomenclature Cap (Tower Jett.)	45-79720-55	Grimes: 33340-55	
4.65	1	Telelight Assembly Consisting of:	45-79720-57	Grimes: 33340-57-327	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
4.65.1	1	Clip	45-79720-45	Grimes: 33340-45
4.65.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.65.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.65.4	1	Nomenclature Cap (Capsule Sep.)	45-79720-59	Grimes: 33340-59
4.66	1	Telelight Assembly Consisting of:	45-79720-65	Grimes: 33340-65-327
4.66.1	1	Clip	45-79720-45	Grimes: 33340-45
4.66.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.66.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.66.4	1	Nomenclature Cap (In Retro Att.)	45-79720-67	Grimes: 33340-67
4.67	1	Telelight Assembly, Consisting of:	45-79720-69	Grimes: 33340-69-327
4.67.1	1	Clip	45-79720-45	Grimes: 33340-45
4.67.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.67.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.
4.67.4	1	Nomenclature Cap (Retro Fire)	45-79720-71	Grimes: 33340-71
4.68	1	Telelight Assembly Consisting of:	45-79720-73	Grimes: 33340-73-327
4.68.1	1	Clip	45-79720-45	Grimes: 33340-45
4.68.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.68.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.68.4	1	Nomenclature Cap (Jett. Retro)	45-79720-75	Grimes: 33340-75
4.69	1	Telelight Assembly, Consisting of:	45-79720-77	Grimes: 33340-77-327
4.69.1	1	Clip	45-79720-45	Grimes: 33340-45
4.69.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.69.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.69.4	1	Nomenclature Cap (Drogue)	45-79720-79	Grimes: 33340-79
4.70	1	Telelight Assembly Consisting of:	45-79720-81	Grimes: 33340-81-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.70.1	1	Clip	45-79720-45	Grimes: 33340-45
4.70.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.70.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.70.4	1	Nomenclature Cap (Main Deploy)	45-79720-83	Grimes: 33340-83
4.71	1	Telelight Assembly, Consisting of:	45-79720-89	Grimes: 33340-89-327
4.71.1	1	Clip	45-79720-45	Grimes: 33340-45
4.71.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.71.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.71.4	1	Nomenclature Cap (0.05g Switch)	45-79720-91	Grimes: 33340-91
4.72	1	Telelight Assembly, Consisting of:	45-79720-93	Grimes: 33340-93-327
4.72.1	1	Clip	45-79720-45	Grimes: 33340-45
4.72.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.72.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.72.4	1	Nomenclature Cap (Rescue Aids)	45-79720-95	Grimes: 33340-95
4.73	2	Telelight Assembly, Consisting of:	45-79720-99	Grimes: 33340-99-327
4.73.1	1	Clip	45-79720-45	Grimes: 33340-45
4.73.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.73.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.73.4	1	Nomenclature Cap (Spare)	45-79720-97	Grimes: 33340-97
4.74	1	Telelight Assembly Consisting of:	45-79720-105	Grimes: 33340-105-327
4.74.1	1	Clip	45-79720-101	Grimes: 33340-101
4.74.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.74.3	1	Nomenclature (Standby - A.C. Auto.)	45-79720-107	Grimes: 33340-107
4.75	1	Telelight Assembly, Consisting of:	45-79720-109	Grimes: 33340-109-327

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.75.1	1	Clip	45-79720-101	Grimes: 33340-101
4.75.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.75.3	1	Nomenclature Cap (Standby - D.C. Auto)	45-79720-111	Grimes: 33340-111
4.76	1	Telelight Assembly, Consisting of:	45-79720-113	Grimes: 33340-113-327
4.76.1	1	Clip	45-79720-101	Grimes: 33340-101
4.76.2	2	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.76.3	1	Nomenclature Cap (O_2 Warning)	45-79720-115	Grimes: 33340-115
4.77	1	Telelight Assembly, Consisting of:	45-79720-117	Grimes: 33340-117-327
4.77.1	1	Clip	45-79720-101	Grimes: 33340-101
4.77.2	2	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.77.3	1	Nomenclature Cap (Recording)	45-79720-119	Grimes: 33340-119
4.78	1	Telelight Assembly, Consisting of:	45-79720-121	Grimes: 33340-121-327
4.78.1	1	Clip	45-79720-101	Grimes: 33340-101

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
4.78.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-49-327
4.78.3	1	Nomenclature Cap (Mayday)	45-79720-123	Grimes: 33340-123
4.79	1	Telelight Assembly, Consisting of:	45-79720-125	Grimes: 33340-125-327
4.79.1	1	Clip	45-79720-101	Grimes: 33340-101
4.79.2	2	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.79.3	1	Nomenclature Cap (Ready)	45-79720-127	Grimes: 33340-127
4.80	1	Telelight Assembly, Consisting of:	45-79720-135	Grimes: 33340-135-327
4.80.1	1	Clip	45-79720-45	Grimes: 33340-45
4.80.2	2	Light Assembly (Red)	45-79720-47	Grimes: 33340-47-327
4.80.3	1	Light Assembly (Green)	45-79720-49	Grimes: 33340-49-327
4.80.4	1	Nomenclature Cap (Start Retro Sequence)	45-79720-133	Grimes: 33340-133
4.81	4	Light Assembly (Amber)	45-79720-103	Grimes: 33340-103-327
4.82	2	Plug, Tower Elec. Disconnect	45-79722-1	Cannon: 39884

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.	
4.83	2	Receptacle, Tower Elec. Disconnect	45-79722-3	Cannon: 39885	
4.84	2	Cover, Tower Elec. Disconnect	45-79722-5	Cannon: 39886	
4.85	1	Receptacle, Umbilical Disconnect Assembly	45-79723-1	Cannon: GMA017072-33	
4.86	57	Fuse (5 Amp)	45-79727-3	Harris: 34020-5	R-1
4.87	5	Fuse Block Assembly, Consisting of:	45-79727-39	Harris: 33000-39	R-1
4.87.1	12	Fuse (5 Amp)	45-79727-3	Harris: 34020-5	
4.87.2	1	Fuse Block Assembly Shell	45-79727-61	Harris: 33000-61	
4.88	7 1	Fuse Holder Cover, Each with Angle	45-79727-7 45-79727-67	Harris: 33000-7 -----	
4.89	7 1	Fuse Holder Cover, Each with Angle	45-79727-9 45-79727-67	Harris: 33000-9 -----	
4.90	13	Fuse (10 Amp)	45-79727-11	Harris: 34020-10	R-1
4.91	1	Fuse Block Assembly, Consisting of:	45-79727-47	Harris: 33000-47	
4.91.1	8	Fuse (10 Amp)	45-79727-11	Harris: 34020-10	
4.91.2	4	Fuse (25 Amp)	45-79727-13	Harris: 34020-25	
4.91.3	1	Fuse Block Assembly Shell	45-79727-63	Harris: 33000-63	
4.92	1 1	Fuse Holder Cover, With Angle	45-79727-17 45-79727-67	Harris: 33000-17 -----	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.	
4.93	1 1	Fuse Holder Cover, With Angle	45-79727-19 45-79727-67	Harris: 33000-19 -----	
4.94	3	Fuse Block Assembly, Consisting of:	45-79727-55	Harris: 33000-55	
4.94.1	4	Fuse (5 Amp)	45-79727-3	Harris: 34020-5	
4.94.2	8	Fuse (10 Amp)	45-79727-11	Harris: 34020-10	
4.94.3	1	Fuse Block Assembly Shell	45-79727-65	Harris: 33000-65	
4.95	3 1	Fuse Holder Cover, Each with Angle	45-79727-31 45-79727-67	Harris: 33000-31 -----	R-1
4.96	3 1	Fuse Holder Cover, Each with Angle	45-79727-33 45-79727-67	Harris: 33000-33	
4.97	25	Switch	45-79729-1	Harris: 34000-3	
4.98	1	Switch - 8 Position Rotary	45-79731-1	Harris: 32000-1	
4.99	6	Toggle Switch	45-79732-1	Cutler-Hammer: 8906K983	
4.100	1	Toggle Switch	45-79732-11	Micro-Switch 4TL27-12	
4.101	12	Toggle Switch	45-79732-13	Cutler-Hammer 8906K984	
4.102	2	Toggle Switch	45-79732-15	Cutler-Hammer 8906K985	
4.103	2	Toggle Switch	45-79732-25	Cutler-Hammer 8906K986	
4.104	3	Toggle Switch	45-79732-39	Micro-Switch 4TL27-3	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

			IDENTIFICATION		
Item	Qty.	Nomenclature	MAC No.	Mfg. No.	
4.105	2	Toggle Switch	45-79732-41	Micro-Switch: 4T127-1	
4.106	1	Plug Assembly-Antenna	45-79736-1	Cannon: 22037-98	
4.107	1	Receptacle Assembly - Antenna	45-79736-3	Cannon: 22037-99	
4.108	5	Plug Assembly - Retrograde and Adapter	45-79736-9	Cannon: 22036-96	
4.109	5	Receptacle Assembly - Retrograde and Adapter	45-79736-11	Cannon: 22037-97	
4.110	2	Floodlight	45-79738-1	Grimes: 43315-1-5004WW	
4.111	1	Panel Assembly, L.H. Switch	45-81014-301	-	
4.112	1	Flashing Recovery Light	45-86702-3	ACR Electronics: ACR 113-M	
4.113	1	Maximum Altitude Sensor	45-87708-11	Donner-Scientific 7005D	
4.114	1	Thrust Cutoff Sensor	45-87709-3	Donner-Scientific 4403-2-300-025	
4.115	1	Plug, Jumper	MCE 0052	Bendix: PT06P-22-55PZ	R-1
4.116	1	Fuse Block Assembly, Consisting of:	45-79727-39	Harris: 33000-39	R-1
4.116.1	10	Fuse (5 Amp)	45-79727-3	Harris: 34020-5	R-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ELECTRICAL (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.	
4.116.2	1	Fuse Block Assembly Shell	45-79727-61	Harris: 33000-61	R-1
4.116.3	2	Conductor, Solid	45-78033-3	-	R-1
4.117	1	Fuse Block Assembly, Consisting of:	45-79727-39	Harris: 33000-39	R-1
4.117.1	9	Fuse (5 Amp)	45-79727-3	Harris: 34020-5	R-1
4.117.2	1	Fuse (10 Amp)	45-79727-11	Harris: 34020-10	R-1
4.117.3	1	Fuse Block Assembly Shell	45-79727-61	Harris: 33000-61	R-1
4.117.4	2	Conductor, Solid	45-78033-3	-	R-1
4.118	4	Conductor, Solid	45-78033-3	-	R-1
4.119	2	Gasket, Electrical Connector	45-78036-3	-	R-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

AUTOMATIC STABILIZATION AND CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Minneapolis Honeywell No.	
5	1	Automatic Stabilization and Control System, Consisting of:	45-87700-303	YG351A-1	
5.1	1	Attitude Gyro (Vertical)	45-87700-3	GG53E-3	
5.2	1	Attitude Gyro (Directional)	45-87700-5	GG53E-4	
5.3	1	Rate Gyro (Pitch)	45-87700-7	GG79A-10	
5.4	1	Rate Gyro (Roll)	45-87700-9	GG79A-11	
5.5	1	Rate Gyro (Yaw)	45-87700-11	GG79A-12	
5.6	1	Acceleration Switch	45-87700-15	GG118A-1	
5.7	1	Calibrator	45-87700-19A	BG161A-4	R-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Bell Aircraft No.
6	1	Reaction Control System, Consisting of:	45-61700-11	
6.1	1	Tank Assy., Auto	45-61700-1029	8060-471-001-9
6.2	1	Disconnect, Fill Vent	45-61700-1037	8060-472-021-3
6.3	1	Valve, Relief (3/8)	45-61700-1041	8060-472-122-1
6.4	3	Valve, Manual Shut-Off (1/4)	45-61700-41	8060-472-024-1
6.5	1	Union	45-61700-53	8060-475-020-6
6.6	3	Tee	45-61700-54	8060-475-021-4
6.7	1	Elbow	45-61700-55	8060-475-023-6
6.8	4	Union	45-61700-56	8060-475-022-4
6.9	1	Union	45-61700-58	8060-475-022-6
6.10	1	T/C Assy., Roll, Lower, 1 & 6 lbs., Auto	45-61700-71	8060-475-013-1
6.11	1	T/C Assy., Roll, Upper, 1 & 6 lbs., Auto	45-61700-72	8060-475-013-2
6.12	3	T/C Assy., Pitch and Yaw, 24 lbs., Auto	45-61700-1025	8060-470-112-9
6.12.1	1	T/C Assy., Pitch and Yaw, 24 lbs., Auto	45-61700-83	8060-470-112-5
6.13	1	Tube Assy., H_2O_2	45-61700-101	8060-475-101-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Bell Aircraft No.
6.14	1	Tube Assy., H_2O_2	45-61700-103	8060-475-103-1
6.15	1	Tube Assy., H_2O_2	45-61700-105	8060-475-105-1
6.16	1	Tube Assy., H_2O_2	45-61700-106	8060-475-106-1
6.17	1	Tube Assy., H_2O_2	45-61700-107	8060-475-107-1
6.18	1	Tube Assy., H_2O_2	45-61700-108	8060-475-108-1
6.19	1	Tube Assy., H_2O_2	45-61700-109	8060-475-109-1
6.20	1	Tube Assy., H_2O_2	45-61700-110	8060-475-110-1
6.21	1	Tube Assy., H_2O_2	45-61700-112	8060-475-112-1
6.22	1	Tube Assy., H_2O_2	45-61700-113	8060-475-113-1
6.23	1	Tube Assy., H_2O_2	45-61700-114	8060-475-114-1
6.24	1	Tube Assy., H_2O_2	45-61700-115	8060-475-115-1
6.25	1	Tube Assy., H_2O_2	45-61700-142	8060-475-138-1
6.26	4	Tube Assy., H_2O_2	45-61700-119	8060-475-119-1
6.27	2	Bottle (He)	45-61700-483	8060-471-002-3
6.28	2	Valve, Manual, Shut-Off (Regulator) (He Fill)	45-61700-405	8060-472-001-1
6.29	2	Valve, Manual, Shut-Off (He Fill) (Regulator)	45-61700-406	8060-472-001-3
6.30	2	Filter	45-61700-407	8060-472-004-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	Bell Aircraft No.
6.31	2	Regulator Assy.	45-61700-1403	8060-472-006-9
6.32	2	Valve, Relief	45-61700-471	8060-472-007-3
6.33	1	Transducer	45-61700-413	8060-472-011-3
6.34	1	Transducer	45-61700-414	8060-472-011-1
6.35	2	Valve, Manual, Shut-Off (H_e VENT)	45-61700-415	8060-472-009-1
6.36	2	Valve, Check	45-61700-417	8060-472-010-1
6.37	2	Tee Similar to (MS24402D4)	45-61700-421	8060-475-026-4
6.38	2	Elbow Similar to (MS24394D4)	45-61700-423	8060-475-028-4
6.39	1	Tee Similar to (MS24395D4)	45-61700-425	
6.40	1	Tee Similar to (MS24390D4)	45-61700-427	
6.41	1	Tube Assy., He	45-61700-430	8060-475-430-1
6.42	1	Tube Assy., He	45-61700-431	8060-475-431-1
6.43	2	Tube Assy., He	45-61700-432	8060-475-432-1
6.44	1	Tube Assy., He	45-61700-442	8060-475-442-1
6.45	1	Tube Assy., He	45-61700-443	8060-475-443-1
6.46	1	Tube Assy., He	45-61700-444	8060-475-444-1
6.47	1	Tube Assy., He	45-61700-445	8060-475-445-1
6.48	1	Tube Assy., He	45-61700-446	8060-475-446-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

REACTION CONTROL SYSTEM (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	Bell Aircraft No.
6.49	1	Tube Assy., He	45-61700-447	8060-475-447-1
6.50	1	Tube Assy., He	45-61700-451	8060-475-451-1
6.51	1	Tube Assy., He	45-61700-453	8060-475-453-1
6.52	1	Tube Assy., He	45-61700-454	8060-475-454-1
6.53	1	Tube Assy., He	45-61700-457	8060-475-457-1
6.54	1	Tube Assy., He	45-61700-458	8060-475-458-1
6.55	1	Tube Assy., He	45-61700-459	8060-475-459-1
6.56	1	Tube Assy., He	45-61700-450	8060-475-450-1
6.57	1	Tube Assy., He	45-61700-461	8060-475-461-1
6.58	1	Tube Assy., He	45-61700-463	8060-475-463-1
6.59	1	Tube Assy., He	45-61700-464	8060-475-464-1
6.60*		T/C Assy., Pitch and Yaw, 24 lbs., Auto, Consisting of:	45-61700-73	8060-470-112-1
6.60.1	1	T/C Assy., Pitch and Yaw, 24 lbs., Auto	45-61700-65	8060-470-001-5
6.60.2	1	Ht. Bar. Assy., Pitch and Yaw, 24 lbs.	45-61700-69	8060-470-106-1

* Item 6.60 is interchangeable with item 6.12 with the only difference consisting of the bracket material and potting compound.

MAC P/N	Potting	Bracket Material
-73	MAC	Titanium
-1025	Bell/MAC	Steel

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

COMMUNICATIONS

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
7		Communications System Consisting of:	45-85700-311	Collins
7.1	1	Transmitter-Receiver, HF Voice	45-85700-3	Collins: 522 1793 205
7.2	1	Transmitter-Receiver, RF Rescue Voice	45-85700-5	Collins: 522 1794 205 (MRR-129JA34)
7.3	2	Transmitter-Receiver, UHF Voice	45-85700-7	Collins: 522 1851 005
7.4	1	Audio Center	45-85700-9	Andrea: AC 75
7.5	2	Receiver, Command	45-85700-11	Motorola: 201-313-00
7.6	2	Decoder, Command	45-85700-13	Motorola: 201-312-98
7.7	1	Transmitter, Telemetry Low Frequency	45-85700-17	Texas Instr: 421923-A1
7.8	1	Transmitter, Telemetry High Frequency	45-85700-19	Texas Instr: 421923-B1
7.9	2	Power Supply, Telemetry	45-58700-81	Texas Instr: 429759-1-3 R-1
7.10	1	Beacon, C-Band Radar	45-85700-25	Avion: 152 A2-1
7.11	1	Beacon, S-Band Radar	45-85700-27	Avion: 152 A500-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

COMMUNICATIONS (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
7.12	1	Beacon, HF/UHF Rescue (Sarah-Seasave)	45-85700-29	Simmonds: 311 006	
7.13	1	Panel, Control	45-85700-31	Collins: 522 1812 004	
7.14	3	Antenna, S and C-Band	45-85700-33	Melpar: R436158-1	
7.15	1	Power Divider, C-Band (Including Matched Cables)	45-85700-35	Melpar: R530310-1	
7.16	1	Power Divider, S-Band (Including Matched Cables)	45-85700-37	Melpar: R530311-1	
7.17	1	Isolator, Bicone	45-85700-43	Collins: 522 1963 202	
7.18	1	Multiplexer, Bicone	45-85700-45	Microphase: 7M769A	R-1
7.19	1	Antenna, UHF Descent	45-85700-49	Collins: 522 1817 005	R-1
7.20	2	Switch, Coaxial	45-85700-51	Transco: 1460 233A	
7.21		Deleted			R-1
7.22	1	Diplexer, HF	45-85700-57	Collins: 522 1813 004	
7.23	1	Line Filter, Telemetry	45-85700-83	Collins: 522 2223 104	R-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	AiResearch No.
8	1	Environmental Control System, Consisting of:	45-83700	
8.1	1	Valve, Emergency Oxygen, Rate Suit	45-83700-33	132186
8.2	1	Valve, Dual Cabin Pressure Control and Repressurization	45-83700-35	102344-1
8.3	1	Valve, Condensate Removal	45-83700-39	PS175210
8.4	1	Regulator, Suit Pressure	45-83700-41	132190
8.5	1	Trap, Solids	45-83700-43	174310
8.6	2	Blower, Internal Circuit	45-83700-49	207970
8.7	4	Valve, Oxygen Check	45-83700-53	123104
8.8	1	Sensor, Blower Pressure Differential	45-83700-55	PS 207179
8.9	1	Absorber, Internal Circuit Water	45-83700-59	175830
8.10	1	Tank, Cooling Water	45-83700-61	175320
8.11	2	Valve, Comfort Control	45-83700-63	121034 MRR:10JA82
8.12	1	Controls, Box	45-83700-65	510352
8.13	2	Cap Assy., Water Line	45-83700-69	PS 173162-1
8.14	1	Valve, Cabin Pressure Relief and Emergency Decompression	45-83700-77	102350

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	AiResearch No.
8.15	1	Valve, Post Landing Outflow	45-83700-79	122216
8.16	1	Valve, Ground Oxygen Inlet	45-83700-81	PS 137205 (Rev. B)
8.17	1	Blower, Equipment	45-83700-425	207990
8.18	1	Valve, Barometrically Actuated	45-83700-85	132198
8.19	1	Valve, Suit Pressure Relief	45-83700-87	130100
8.20	1	Orifice, Flow Limiting	45-83700-89	PS 174410
8.21	2	Valve, Freon 114 Check	45-83700-91	PS 132200
8.22	1	Valve, Ground Ventilation Inlet	45-83700-95	122294-1
8.23	1	Valve, Snorkel Inflow	45-83700-99	121046
8.24	1	Valve, Snorkel Outflow	45-83700-101	121048
8.25	1	Switch, Pressure	45-83700-103	133186
8.26	1	Valve, Solenoid-Switch	45-83700-105	319190-2
8.27	1	Valve, Pressure Test	45-83700-107	PS 130098
8.28	1	Assembly, Oxygen Bottle Consisting of:	45-83700-113	134292
8.28.1	1	Bottle, Oxygen	45-83700-19	134210
8.28.2	1	Valve, Oxygen Shutoff	45-83700-23	132180
8.28.3	1	Coupling, Oxygen Bottle Filler	45-83700-97	137203-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	AiResearch No.
8.28.4	1	"T" Fitting, High Pressure	45-83700-109	137455
8.28.5	1	Cap	45-83700-123	MS 21914-2
8.28.6	1	Cap	45-83700-125	MS 21914-4
8.28.7	1	Elbow	45-83700-127	MS 21908-4C
8.28.8	2	Nut	45-83700-129	S 8079-229
8.28.9	1	Packing	45-83700-131	S 8469M111
8.28.10	3	Packing	45-83700-133	S 8469M121
8.28.11	AS/R	Locknut Wire	45-83700-135	MS 20995C20
8.28.12	2	Retainer	45-83700-195	137529-1
8.29	1	Assembly, Launch Oxygen Bottle, Consisting of:	45-83700-115	134294
8.29.1	1	Bottle, Launch Oxygen	45-83700-21	134212
8.29.2	1	Valve, Oxygen Shutoff	45-83700-23	132180
8.29.3	1	Coupling, Oxygen Bottle Filler	45-83700-97	137203-1
8.29.4	1	"T" Fitting, High Pressure	45-83700-111	137590
8.29.5	1	Cap	45-83700-125	MS 21914-4
8.29.6	1	Nut	45-83700-129	S 8079-229
8.29.7	1	Packing	45-83700-131	S 8469M111

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION AiResearch No.
8.29.8	3	Packing	45-83700-133	S 8469J121
8.29.9	AS/R	Locknut Wire	45-83700-135	MS 20995C20
8.29.10	1	Union	45-83700-137	MS 21902-4C
8.29.11	1	Retainer	45-83700-195	137529-1
8.30	1	Assembly, Normal Oxygen Pressure Regulator, Consisting of:	45-83700-119	132230
8.30.1	2	Reducer, Oxygen Pressure	45-83700-27	PS132184
8.30.2	1	Valve, Oxygen Check	45-83700-51	PS 132194
8.30.3	1	Cap	45-83700-123	MS 21914-2
8.30.4	1	Cap	45-83700-125	MS 21914-4
8.30.5	1	Elbow	45-83700-127	MS 21908-4C
8.30.6	1	Nut	45-83700-129	S 8079-229
8.30.7	6	Packing	45-83700-133	S 8469M121
8.30.8	AS/R	Locknut Wire	45-83700-135	MS 20995C20
8.30.9	1	Cap	45-83700-139	AN 929-4C
8.30.10	4	Stud, Pressure Reducer Orifice	45-83700-141	137394
8.30.11	4	Washer	45-83700-143	S 8157N96-063
8.30.12	4	Nut	45-83700-145	S 8079C54

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	AiResearch No.
8.30.13	4	Packing	45-83700-147	S 8469M172
8.30.14	4	Ring	45-83700-149	MS 28774-10
8.30.15	1	Manifold, Pressure Reducer Outlet	45-83700-151	137454
8.30.16	1	Manifold, Pressure Reducer Inlet	45-83700-153	137453
8.30.17	1	Retainer	45-83700-195	137529-1
8.31	1	Assembly, Emergency and Purge Oxygen, Consisting of:	45-83700-121	132232
8.31.1	1	Reducer, Oxygen Pressure	45-83700-29	PS 132184-1
8.31.2	1	Reducer, Oxygen Pressure	45-83700-31	PS 132196
8.31.3	1	Valve, Oxygen Check	45-83700-51	PS 132194
8.31.4	2	Cap	45-83700-125	MS 21914-4
8.31.5	1	Elbow	45-83700-127	MS 21908-4C
8.31.6	2	Nut	45-83700-129	S 8079-229 (MRR:10JE3)
8.31.7	1	Packing	45-83700-131	S 8469M111
8.31.8	5	Packing	45-83700-133	S 8469M121
8.31.9	AS/R	Locknut Wire	45-83700-135	MS 20995C20
8.31.10	1	Cap	45-83700-139	AN 929-4C

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION AiResearch No.
8.31.11	2	Stud, Pressure Reducer Orifice	45-83700-141	137394
8.31.12	3	Washer	45-83700-143	S 8157N96-063
8.31.13	4	Nut	45-83700-145	S 8079C5R
8.31.14	3	Packing	45-83700-147	S 8469M172
8.31.15	3	Ring	45-83700-149	MS 28774-10
8.31.16	1	Stud, Pressure Reducer Orifice	45-83700-155	137459
8.31.17	1	Stud, Pressure Reducer Orifice	45-83700-157	137460
8.31.18	1	Washer	45-83700-159	S 815N238-063
8.31.19	1	Packing	45-83700-161	S 8469M6
8.31.20	1	Ring	45-83700-163	MS 28774-11
8.31.21	1	Cap	45-83700-165	AN 929-6C
8.31.22	1	Support, Pressure Reducer Outlet	45-83700-167	137462
8.31.23	1	Support, Pressure Reducer Inlet	45-83700-169	137461
8.31.24	1	Packing	45-83700-171	S 8469M120
8.31.25	1	Elbow	45-83700-173	MS 21907-4C
8.31.26	2	Retainer	45-83700-195	137529-1

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	AiResearch No.
8.32	1	Manifold, Suit Inlet	45-83700-175	174253
8.33	1	Duct, Cabin Evaporator Steam	45-83700-177	174363
8.34	1	Manifold, Compressor Outlet	45-83700-179	174479
8.35	1	Fitting, Suit Pressure Regulator Outlet	45-83700-181	174295
8.36	1	Duct, Water Separator Exit	45-83700-183	174364
8.37	1	Manifold, Compressor Inlet	45-83700-187	174366
8.38	1	Bracket, Cabin Pressure Control Valve	45-83700-193	174693
8.39	1	Oxygen Lines from Normal Oxygen Bottles to Manifold Inlet	45-83700-197	174507
8.40	1	Oxygen Lines from Launch O_2 Bottle to Manifold Inlet	45-83700-205	174525
8.41	1	Oxygen Lines from O_2 Manifold to O_2 Pressure Switch	45-83700-235	174688
8.42	2	Gasket, Suit Heat Exchanger	45-83700-237	174247
8.43	1	2.5 In. Marman Clamp	45-83700-255	4266
8.44	6	2.31 In. Marman Clamp	45-83700-257	4365
8.45	1	2.68 In. Marman Clamp	45-83700-259	4365
8.46	4	2.75 In. Marman Clamp	45-83700-261	4365
8.47	1	2.87 In. Marman Clamp	45-83700-263	4365

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

			IDENTIFICATION	
Item	Qty.	Nomenclature	MAC No.	AiResearch No.
8.48	6	"O" Ring for Marman Clamp 4365-231	45-83700-265	S 8057BE-265
8.49	1	"O" Ring for Marman Clamp 4365-268	45-83700-267	S 8057BE-245
8.50	8	"O" Ring for Marman Clamp 4365-275	45-83700-269	S 8057BE-208
8.51	1	"O" Ring CO_2 Absorber and Evaporator	45-83700-271	2-242
8.52	3	"O" Ring System Shutoff Valve 122294 and Duct 174295	45-83700-273	S 8469G-141
8.53	1	"O" Rings for Boss on Launch Purge Valve	45-83700-275	S 8469G-120
8.54	14	"O" Rings	45-83700-277	S 8469G-121
8.55	4	"O" Rings for Boss on Compressor Inlet Duct	45-83700-279	S 8469G-5
8.56	1	Union Bulkhead	45-83700-281	AN 832-4D
8.57	4	Tee-Bulkhead on Run	45-83700-283	AN 804-4D
8.58	4	Union	45-83700-285	AN 815-4D
8.59	2	Reducer	45-83700-287	AN 919-1D
8.60	1	Tee	45-83700-291	AN 824-4D
8.61	1	Plug	45-83700-293	AN 814-4D

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	AiResearch No.
8.62	4	45° Elbow-Flared Tube Bulkhead	45-83700-295	AN 837-4D
8.63	6	Screw	45-83700-701	31363-4
8.64	2	90° Elbow-Flared Tube Bulkhead	45-83700-409	AN 833-4D
8.65	1	CO_2 Absorber and Odor Control Internal Circuit	45-83700-417	175950
8.66	1	Manifold, Solids Trap Exit	45-83700-437	174365
8.67	1	Exchanger, Internal Circuit Heat	45-83700-439	174250-1 MRR: 30A10
8.68	1	Exchanger, Cabin Equipment Heat	45-83700-441	174260-1
8.69	1	Duct, Ground Vent. Inflow	45-83700-443	175212
8.70	1	Valve, System Shutoff	45-83700-455	122260-1 MRR-10JA30
8.71	2	Clamp Rings, 2.195 to 2.2000 dia.	45-83700-469	175346-1
8.72	1	Clamp Rings, 2.573 to 2.578 dia.	45-83700-471	175346-2
8.73	4	Clamp Rings, 2.630 to 2.635 dia.	45-83700-473	175346-3
8.74	1	Freon Orifice for 174250-1	45-83700-475	174906-1
8.75	1	Freon Orifice for 174260-1	45-83700-477	174906-2

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	AiResearch No.
8.76	2	"O" Ring for Plug at CO_2 Transducer Ports	45-83700-487	3-16
8.77	1	Line Assembly	45-83010-3	-----
8.78	1	Line Assembly	45-83010-5	
8.79	1	Line Assembly	45-83010-7	
8.80	1	Line Assembly	45-83010-9	
8.81	1	Line Assembly	45-83010-11	
8.82	1	Line Assembly	45-83010-13	
8.83	1	Line Assembly, Water Supply	45-83010-15	
8.84	1	Line Assembly, Cabin Temperature	45-83010-17	
8.85	1	Line Assembly	45-83010-69	MRR:40AE26
8.86	1	Line Assembly	45-83010-21	
8.87	1	Line Assembly	45-83010-23	
8.88	1	Line Assembly	45-83010-25	
8.89	1	Line Assembly	45-83010-39	
8.90	1	Line Assembly	45-83010-41	
8.91	1	Line Assembly	45-83010-45	
8.92	1	Line Assembly	45-83010-46	
8.93	1	Line Assembly	45-83010-48	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

ENVIRONMENTAL CONTROL SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	AiResearch No.	
8.94	1	Line Assembly	45-83010-49		
8.95	1	Line Assembly	45-83010-50		
8.96		Deleted			R-1
8.97	1	Line Assembly	45-83010-52		
8.98	1	Line Assembly	45-83010-53		
8.99	1	Line Assembly	45-83010-54		
8.100	1	Line Assembly	45-83010-55		
8.101	1	Line Assembly	45-83010-56		
8.102	1	Line Assembly	45-83010-57		
8.103	1	Line Assembly	45-83010-58		
8.104	1	Line Assembly	45-83010-59		
8.105	1	Line Assembly	45-83010-60		
8.106	1	Line Assembly	45-83010-61		
8.107	1	Line Assembly	45-83010-62		
8.108	1	Line Assembly	45-83010-63		
8.109	1	Line Assembly	45-83010-64		
8.110	1	Line Assembly	45-83010-65		
8.111	1	Line Assembly	45-83010-66		

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.	
9		Instrumentation System, Consisting of:			
9.1	1	Camera, Earth & Sky, 70 mm with 75 mm Lens	45-88706-1	Mauer: 220-400-00	
9.1.1	AS/R	Film, 70 mm, on Aluminum Reels	-----*	DuPont: P931A	
9.1.2	1	Filter, Noise	45-88706-3	Mauer: 220-400-77	
9.2	1	Camera, Instrumentation Observation, 16 mm	45-88704-3	Milliken: DBM7 MRR: 30AA59 (S/N 7104)	
9.2.1	1	Lens, 10 mm, f1.8	-----	Bell & Howell: "Ingenue"	
9.2.2	AS/R	Film, 16 mm, on Aluminum Reels	-----*	DuPont: P931A	
9.3	1	Tape Recorder, Including	45-88707-901	Consolidated Electrodynamics (CEC)	R-1
9.3.1		Deleted			R-1
9.3.2	1	Speed Change Kit (1-7/8 ips)	45-88707-13	CEC	
9.3.3	1	Transport Assembly	45-88707-15	CEC	
9.3.4	2	Reel	45-88707-17*	CEC	
9.3.5	3600 Ft.	Tape, 1/2 inch	-----	Minn. Mining & Mfg. #199	R-1

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION (Continued)

			IDENTIFICATION		
Item	Qty.	Nomenclature	MAC No.	Mfg. No.	
9.4	1	Tape Recorder Assembly, Playback, Including:	45-88104-1	-----	
9.4.1	2	Tape Recorders, "Midge-tape"	-----*	Mohawk: Model 400	
9.4.2	1	Receptacle	-----	Bendix: PT07H-12-8P	
9.4.3	2	Transformer, Deci-Ouncer	-----	United Transformer-DO-T5	
9.4.4	AS/R	Wire	-----	Raytherm: RT-26 (7) U1-4	
9.5	1	Instrumentation Package "A" Including:	45-88100-1	-----	
9.5.1	1	D.C. Power Supply, 3V Monitor	45-88203-1	-----	
9.5.2	1	Resistance Element, A.C. Power	45-88206-1	-----	
9.5.3	3	Resistance Element, Amplifier	45-88207-15	-----	R-1
9.5.4	2	Amplifier, Body Probe	45-88207-5	-----	
9.5.5	1	Amplifier, Body Temperature	45-88215-5	-----	
9.5.6	1	Amplifier, Body Temperature	45-88215-7	-----	
9.5.7	1	PDM/PAM Commutator/ Keyer	45-88709-3	Gen. Devices: 1208D-2B	

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
9.5.8	1	PDM/PAM Commutator/Keyer	45-88709-3	Gen. Devices: 1208D-2P	
9.5.9		Deleted			R-1
9.5.9.1	2	Card	45-88218-1	-----	R-1
9.5.10	2	Probe, Temperature, Cabin Air	45-88720-3	Transonics: 1182B	
9.5.11	1	Transformer, Filament	-----	Comm. Accessories: 76-0056-35	
9.5.12	1	Capacitor	-----	GE: 29F592 (10 μf)	
9.5.13	1	Resistor	-----	Int. Resistor Co.: GBT-1/2 470K 10%	
9.6	1	Instrumentation Package "B", Including:	45-88101-9	-----	
9.6.1	2	Accelerometer, "Y" & "X" Axis, $\pm$ 4g	45-88712-5	Donner: 4310-2	
9.6.2	1	Accelerometer, "Z" Axis, $\pm$ 30g	45-88712-3	Donner: 4310-1	
9.6.3	2	Voltage Controlled Oscillator - 1.3 KC	45-88700-13	Dorsett: O-8M1.3KC	
9.6.4	2	Voltage Controlled Oscillator - 1.7 KC	45-88700-15	Dorsett: O-8M1.7KC	
9.6.5	2	Voltage Controlled Oscillator - 2.3 KC	45-88700-17	Dorsett: O-8M2.3KC	
9.6.6	2	Voltage Controlled Oscillator - 10.5 KC	45-88700-27	Dorsett: O-8MA10.5KC	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.	
9.6.7	1	Compensating Oscillator	45-88700-53	Dorsett: 20-8M	
9.6.8	1	Mixer Amplifier	45-88700-55	Dorsett: ASM-8M	R-1
9.6.8.1	1	Mixer Amplifier	45-88217-1B	-	R-1
9.6.9	2	Amplifier, Rate Signal	45-88214-13	-	R-1
9.6.10	1	Amplifier, Rate Signal	45-88214-15	-	R-1
9-6.11	1	Noise Level Pickup System Including:	45-88713-1	Gulton: KPL-1	
9.6.11.1	1	Transducer	45-88713-7	Gulton: R420M-1MAC	
9.6.11.2	1	Amplifier	45-88713-9	Gulton: R4400-1MAC	
9.6.11.3	1	Cable Assembly	-	Gulton: KPL-101	
9.7	1	Instrumentation Package "C", Including:	45-88102-7	-	
9.7.1	2	Solenoid Voltage Attenuators	45-88205-1	-	
9.7.2	1	Respiration Calibration Attenuator	45-88208-1	-	
9.7.3	1	Amplifier, Horizon Scanner	45-88212-1	-	
9.7.4	2	Amplifier, D.C.	45-88215-1	-	
9.7.5		Deleted			

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

INSTRUMENTATION (Continued)

			IDENTIFICATION		
Item	Qty.	Nomenclature	MAC No.	Mfg. No.	
9.7.6		Deleted			R-1
9.7.7	1	Transducer, Cabin Pressure	45-88705-3	CEC: 4-380MJ-25A	
9.7.8	1	Programmer	45-88710-5A	Wheaton: M-112-5A	
9.8	1	Transducer, Crewman Simulator Pressure	45-88705-3	CEC: 4-380MJ-25A	
9.9	2	Transducer, Crewman Simulator Inlet Air Temperature	-	Ruge: BN-274	
9.10	2	Transducer, Heat Sink Temperature	45-88721-3	Ruge: 3173	
9.11	2	Transducer, Inner Skin Temperature	45-88721-1	Ruge: 3172	
9.12	2	Transducer, Outer Skin Temperature	-	Transonics: 2277	
9.13	1	Transducer, CO_2 Partial Pressure	45-88715-3	Beckman: 71200	
9.14	1	Transducer, Static Pressure	45-88705-5	CEC: 4-380MJ-15A	
9.15	1	Analyzer, Vibration and Acoustical	45-88711-1	ASCOP: SA-40	
9.16	1	Vibration Measuring System Consisting of:	45-88714-3	Endevco: 2829	
9.16.1	1	Accelerometer	45-88714-9	Endevco: 2213M5	
9.16.2	1	Amplifier	45-88714-11	Endevco: 2620	

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Radioplane No.	
10		Landing and Post-Landing System, Consisting of:	45-41700-301	R-5100-301	
10.1	1	Drogue Chute System, Consisting of:	45-41700-3	R-5102-309	
10.1.1	1	Drogue Chute Assembly, Consisting of:	45-41700-99*	-	
10.1.1.1	1	Drogue Chute	45-41700-29*	R-5103-309	
10.1.1.2	1	Drogue Bag	45-41700-11*	R-5104	
10.1.1.3		Deleted			R-1
10.1.2	1	Mortar Tube	45-41700-143*	R-5109-307	
10.1.3	1	Mortar Sabot	45-41700-19*	R-5126	
10.1.4	1	Mortar Cover Assembly	45-41700-21*	R-5134	
10.2	1	Landing Parachute Assembly, Consisting of:	45-41700-5	R-5115	
10.2.1	1	Main Chute System, Consisting of:	45-41700-95*	-	
10.2.1.1	1	Landing Parachute, Heavy Riser	45-41700-219*	R-5157-321	
10.2.1.2	1	Bag, Main Chute Deployment	45-41700-221	R-5116-305	R-1
10.2.1.3	1	Lanyard, Antenna	45-41700-181*	R-5135-309	
10.2.1.4	2	Cutter Reef - 4 Second Reefing	45-41700-195*	101092-1	

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Radioplane No.	
10.2.1.5	1	Reefing Line	45-41700-199*	R-5157-95	
10.2.1.6	1	Bridle, Parachute	45-41700-201*	R-5205	
10.2.2	1	Reserve Chute System, Consisting of:	45-41700-97*	-	
10.2.2.1	1	Landing Parachute, Heavy Riser	45-41700-219*	R-5157-321	
10.2.2.2	1	Pilot Parachute	45-41700-193*	R-5204	
10.2.2.3	1	Bag, Reserve Chute Deployment	45-41700-223*	R-5117-309	
10.2.2.4	1	Lanyard, Pilot Chute	45-41700-149*	R-5136-301	
10.2.2.5	1	Reefing Line	45-41700-199*	R-5157-95	
10.2.2.6	1	Bridle, Parachute	45-41700-237*	R-5153-301	R-1
10.2.4	2	Bag, Landing Parachute Ejector	45-41700-37*	R-5118-301	
10.2.5	2	Disconnect, Landing Parachute	45-41700-191	R-5127-301	
10.2.6	1	Projectile Assembly, Pilot Chute Deploy Gun	45-41700-127	101070-23	
10.2.7	1	Shear Pin, Pilot Chute Deploy Gun	45-41700-63	101070-17	
10.2.8	2	Baroswitch, 10,600 Ft.	45-41700-163	101080-15	
10.2.9	1	Switch, Inertia	45-41700-105	58215-303	

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM (Continued)

			IDENTIFICATION		
Item	Qty.	Nomenclature	MAC No.	Radioplane No.	
10.2.10	1	Packet Assembly, Dye Marker	45-41700-85*	R-5122	
10.2.11	2	Baroswitch, 21,000 Ft.	45-41700-245	101080-21	R-1
10.2.12	2	Strap Assembly, Adjustable Retaining	45-41700-101	R-5195	
10.2.13	2	Recovery Sequence Controller Assembly	45-41030-1	R-5130-307 (Mod.)	R-1
10.2.14	1	Strap Nonadjustable, Insulated	45-41700-117	R-5196	
10.3	1	Body Assembly, Gun, Pilot Chute Deploy	45-41700-171	101070-33	
10.4		Deleted			R-1
10.5	1	Package Assembly, Explosives, Consisting of:	45-41700-73*	R-5183	
10.5.1	1	Electric Squib, Deployment Gun	45-41700-213*	58082	
10.5.2	1	Squib Cartridge, Electric, (Drogue Mortar)	45-41700-211*	58081	
10.5.3	2	Cartridge, Squib Electric, (Parachute Disconnect)	45-41700-209*	58080	
10.5.4	1	Cartridge, Main Charge, Deployment Gun	45-41700-167*	101070-31	
10.5.5	1	Gas Generator Assembly	45-41700-215*	58217-15	

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

LANDING AND POST-LANDING SYSTEM (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Radioplane No.
10.5.6	1	Gas Generator Assembly	45-41700-217*	38217-17
10.6	1	Timer, Smoke Generator	45-41700-107	TDR-450
10.7	2	Cutter Reefing - 16 Second	45-41700-197*	101092-7
10.8	2	Mounting Bracket	45-41700-205	101092-3
10.9	1	Bag, SOFAR Bomb	45-41700-227	R5207

* These items to be shipped to launch site for installation.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

PYROTECHNICS*

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	Mfg. No.	
11		Pyrotechnic Devices, Consisting of:	45-72001-2		
11.1	**	Squib, Deployment Gun	45-41700-213		
11.2	**	Squib Cartridge, Drogue Mortar	45-41700-211		
11.3	**	Gas Generator, Main Chute	45-41700-215		
11.4	**	Gas Generator, Reserve Chute	45-41700-217		
11.5	**	Squib Cartridge, Parachute Disconnect	45-41700-209		
11.6	**	Cartridge, Deployment Gun	45-41700-167		
11.7		Deleted			R-1
11.8	6	Explosive Bolt, Clamp Ring	45-72702-19	Olin Mathieson: 112C-2	R-1
11.9	1	Explosive Bolt, Retrograde Rocket Ejector	45-72704-9	Olin Mathieson: 113C-3	
11.10	6	Explosive Disconnect Assembly Consisting of:	45-72705-1	Beckman-Whitley: 2243C	
11.10.1	2	Explosive Cell	45-72705-5	Beckman-Whitley: 10084	R-1
11.10.2	1	Ring Assembly	45-72705-7	Beckman-Whitley:	R-1

* Pyrotechnic devices to be shipped to launch site for installation, except for Items 11.14 and 11.15.
** Quantities defined under applicable systems.

APPENDIX I-C

CONTRACTOR-FURNISHED EQUIPMENT - CONTRACTOR INSTALLED

PYROTECHNICS* (Continued)

Item	Qty.	Nomenclature	IDENTIFICATION MAC No.	IDENTIFICATION Mfg. No.
11.11		Antenna Fairing Ejector Pyrotechnics, Including:	45-72703-17	
11.11.1	2	Cartridge	-	Olin Mathieson: ARD863-1
11.11.2	1	Cartridge	-	McCormick Selph: 2561
11.11.3	1	Cartridge	-	Frankford Arsenal: M67(T237)
11.12	4	Initiator (Chute Disconnect, Capsule and Tower Separation)	-	Frankford Arsenal: XM-41
11.13		Deleted		R-1
11.14	1	Actuator, Snorkel Valve	45-79013-1	-
11.15	1	Actuator, Snorkel Valve	45-79013-3	-

* Pyrotechnic devices to be shipped to launch site for installation, except for Items 11.14 and 11.15.